THE
Journal of Electricity, Power and Gas
WITH WHICH IS INCORPORATED
The Engineers' Architects' and Builders' News

VOLUME XVII. SAN FRANCISCO, CAL., JULY 21, 1906 No. 3

The Construction and Operation of Gold Dredging Machinery

BY PROF. C. L. CORY

The history of the industry of gold dredging, though comparatively short in the matter of time, is marked by rapid strides in the development of a machine which will handle efficiently the various placer gravel deposits, containing gold only in such quantities and under such conditions as not to be profitably worked by hand.

New Zealand was the birthplace of successful dredging for gold and was also the locality in which that character of

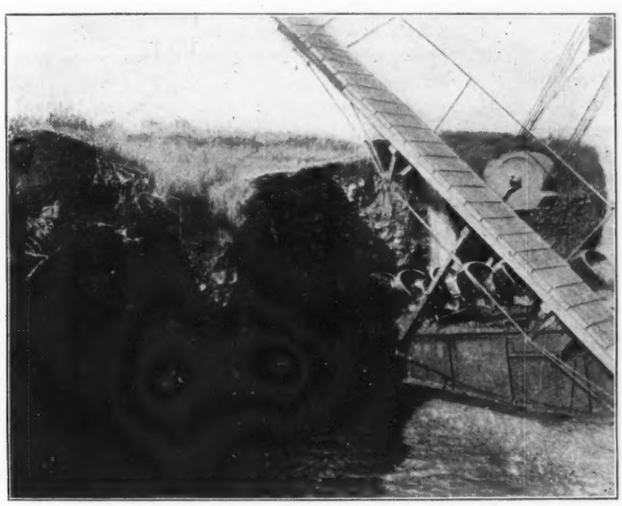


Figure 1.

mining first became established as a successful industry. During the last forty years all classes and types of machines have there been experimented with, but in the course of development every other type has given way to either an open or close connected continuous bucket dredge. At the present time gold dredges are successfully operated in British Columbia, Australia, Africa, China, Siberia, and the United States. In the last named, the dredges are located on the Yukon in Alaska, the Snake river in Oregon, in Idaho and Montana, and in California. The most extensive work probably is being done in California and it is from a general study of the conditions and the mehods of operating in the Oroville and the Folsom districts that this article is written.

The first dredges were of the "dipper" and the "clam shell" type. Although a dipper dredge will handle any ordinary material it is not economical or efficient for gold dredging service, as it so disturbs the gravel in the act of digging that much of the gold sinks to the bottom and is lost. A machine must be so designed as to dig the gravel from underneath and with a minimum amount of disturbance, since excessive agitation of gold-bearing gravel has a tendency to precipitate the gold. The joints or doors of neither the dipper nor clam shell buckets can be made permanently water tight, so that much of the gold is lost in the act of dredging, and with both of these types the material is deposited intermittently, in large quantities, and at some distance from the center of the boat, making it exceedingly difficult to feed to the gold saving apparatus.

Suction dredges have also been tried but have been found inefficient, on account of the small area which is under the influence of the suction pipe, and because they will not handle the stones and boulders which abound in many of the richest placers. Only the gravel which is immediately under the suction pipe will be collected along with its gold, since outside that area the velocity of flow is not great enough to prevent the high specific gravity of the gold from precipitating it on to the bed rock.

Hence the elevator on chain-bucket type is the dredge best adapted to the conditions presented in placer mining. The action of the succession of buckets is slow and steady; the material is taken from the bottom with a minimum amount of agitation and in a manner best calculated to hold the gold, and the buckets, being water tight, retain their entire contents until emptied by inversion. The delivery of the material is continuous, and at the center of the boat, instead of being intermittent and at a distance over the side of the boat, as in the dipper dredge.

The buckets carry considerable water, which facilitates the washing operation, and the material being brought up in smaller masses than by the dipper dredge is more easily broken up and disintegrated in the screen.

Although the digging apparatus is the most vital point in the construction of the dredge, there has been a marked development in the other essential features of the machine, The functions which a dredge must perform are as follows:

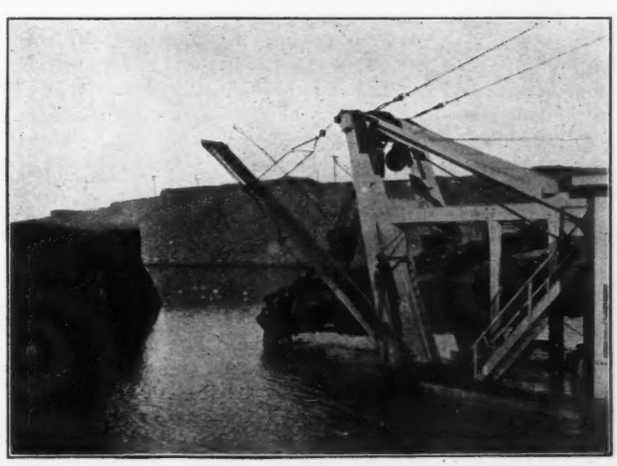


Figure 2.

Figure 3.

1. Dig a large amount of gravel in a given time.
2. Screen and wash all the material the bucket line can deliver.
3. Save all the gold.
4. Dispose of the tailings.

A dredge to perform the above operations consists of the following essential parts:

1. A boat and the appliances for handling it.
2. A chain of buckets for digging the material, elevating it to the proper height and delivering to the screens.
3. Shakers or screens to separate the coarse from the fine material containing the gold.
4. Gold saving apparatus for handling this fine material and collecting the gold.
5. A conveyor or stacker to elevate and discharge the washed gravel at such a distance in the rear as not to interfere with the handling of the boat.

The hull of the dredge is practically rectangular in ground plan, the forward half being in two parts separated by an opening called the well hole. It is constructed of timber in almost every case, although in Africa boats are being constructed on steel hulls. On the bow of the boat is built the "bow gantry," from which is supported the lower end of the digging ladder. About the center of the boat the "main gantry" supports the upper end of the digging ladder and the main drive of the bucket chain. At the rear end of the boat is the "stern gantry" which supports the tail sluices, the conveyor ladder and the spuds, in case there are any. All the gantries are securely braced and tied to each other The manipulation of the boat is accomplished by means of several cables anchored at some distance on shore. These consist of two side lines passing through sheaves at the bow of the boat and used for feeding along the face of the cut, two rear lines for backing away from the cut, and, in one general type, a head line used for holding the boat up to its work. In several makes of dredges this head line is replaced by two immense vertical beams hung through close fitting openings in the hull immediately under the stern gantry. These beams or spuds have pointed ends and are dropped to the bottom of the pond to hold the boat in position. One is of steel and called the working spud, and is used for holding the bucket line up to the face of the cut. The other is of timber and is used to advance the working spud.

The spud and the head line methods each have their advantages. The spuds are more rigid and more suited for working hard-digging material, though the strains on the boat are necessarily greater. The head line method is more suited to loose gravel and surface work, and the give of the cable reduces the strains on the bucket line. The face of the cut in the spud method is concave toward the boat, while with the head line it is convex and can be made much wider by using a long cable.

All these cables, together with those for raising and lowering the bucket, and conveyor ladders are wound on electrically driven winches controlled from the operating room.

The bucket line, as before stated, consists of a series of buckets connected together so as to form a continuous chain. It is either of the close connected type in which bucket follows bucket or the open type in which bucket and link alternate. Since there are twice the number of buckets on the close connected chain, it will handle more material if the lines are operated at the same speed; but where large boulders are encountered the open type is safer, since there is much less danger of the buckets being crushed or the line being broken by a boulder being jammed between buckets in turning round the lower end of the ladder.

The speed of the line in average practice ranges from forty to fifty feet per minute. This dumps from eighteen to twenty-eight buckets per minute in the close connected type and from twelve to fourteen in the open type. The buckets vary in size, shape and make up, but it can generally be stated that a cast steel bottom piece, with sheet steel hood and manganese or steel lips, the latter with reinforced cutting edges, has thus far shown itself best adapted to the work. The shape is also a very important consideration and the best types are so built as to deliver the material freely and not carry any appreciable quantity back into the well hole. To attain this clean dumping property it is of advantage to give the bucket a rounded shape as against an oblong shape. The lips are so connected to the buckets as to be easily replaceable, as the greatest wear shows itself here. The weakest portions of the buckets are the eyes and the surfaces coming in contact with the wearing plates on upper and lower tumblers, around which the chain revolves. The pins connecting the buckets to each other, or to the links, are made of various materials, but the best results are obtained from a high carbon steel in the larger sizes of pins, while manganese steel has shown good wear on the smaller pins. These pins work against replaceable manganese steel bushings, which give good satisfactory action.

Dredgers are usually classed by manufacturers according to the capacity of the buckets. On the standard boats they are either of three, five or seven and one-half cubic feet capacity.

The ladder which carries the bucket line consists of a built up steel girder, either of the plate or box girder type, stiffened by truss rods on the lower side. It is pivoted at its upper end, the lower end being free to move in a vertical plane and raised and lowered by means of cables passing through a combination of sheaves on the bow gantry. The length of the ladder depends on the depth of the material to be handled. On either end of the ladder are the upper

Figure 4.

and lower tumblers over which the bucket chain passes. These tumblers vary in shape on different types of dredges from square to hexagonal. In the design of the top tumbler quick dumping is a necessary feature, so that all the material shall be thrown into the hopper and not be carried back into the well hole. This action is best accomplished by means of a square tumbler, but the bad feature of this shape is that as each bucket arrives at the tumbler it settles suddenly in its place and produces a distinct shock. The square tumbler is

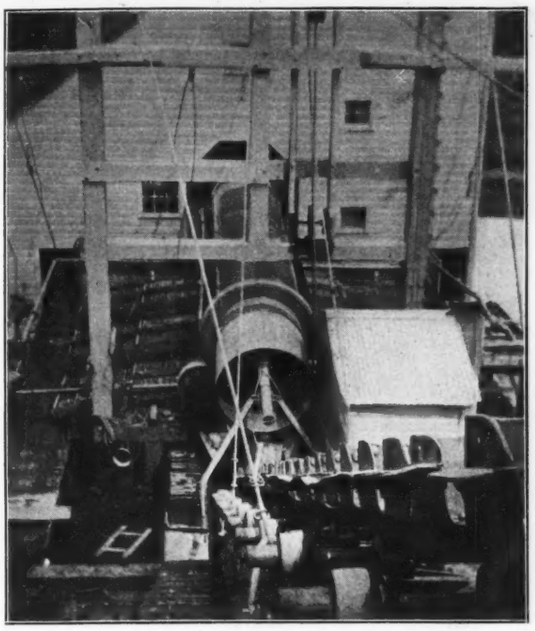


Figure 5.

used at the present time on a certain line of boats and the action described is quite noticeable. Of the different types of tumbler used the hexagonal one produces the least shock, but at the same time its dumping action is less efficient.

The lower tumbler usually consists of two cast steel cheeks mounted at some distance apart on a connecting thimble. It is rigidly connected to a shaft running in bearings affixed to the lower end of the digging ladder. The cheeks of the tumbler and all other points of contact are faced with manganese or nickel steel. These two metals are the only ones that have withstood successfully the wear and tear at these points.

The upper tumbler, through which motion is transmitted to the buckets, usually consists of a cast steel core mounted on the main driving shaft. This core is also fitted with wearing plates of manganese or nickel steel and is built with a set of lugs which engage the buckets and draw them up.

On the upper side of the ladder rollers are placed about five feet apart, which support the bucket line. They are made quite massive and in some types they have been provided with an external manganese shell, which has improved their wearing qualities. Occasionally the buckets have a tendency to run off the line of the ladder and a device, by which the roller may be adjusted to "cut" the line of the buckets, is quite an effective remedy for this trouble. All the bearings of the ladder are provided with compression grease cups.

In latest types the upper end of the ladder is suspended from the upper tumbler shaft. This overcomes the difficulties due to an eccentric suspension of the ladder, which causes the bucket line to be lifted off the upper rollers in certain positions of the ladder, especially when working at the surface.

The hopper into which the gravel is dumped is in some cases provided with a gravel cushion upon which the material falls, while in others the bottom of the hopper is lined with steel delivery plates, which necessarily suffer considerable wear.

The material passes from the hopper out into the separating apparatus, being washed down by two or more streams of water pumped into the top of the hopper by an independent pumping unit. Of the separating devices, there are two distinct classes, the revolving screen and the shaking screen types. The latter consists of a cradle made up of flat steel plates, suspended by hinged rods which permit the shaker to swing back and forth longitudinally. These plates lead from directly under the hopper and are inclined toward the rear of the boat, so that as the screen swings back and forth the material is gradually worked toward the stacker. The shaker plates are of sheet steel about three-eighths of an inch thick, perforated with small holes about three-eighths of an inch in diameter and about three-quarters of an inch apart. These holes are countersunk from the under sides so as to prevent clogging, since any material entering the holes is bound to pass through. Above the screen one or more perforated pipes furnish numerous jets of water under high pressure, which play on the material and thoroughly wash it. The fine sand and gold passing through the shaker fall on to distributing plates, which carry it to the riffles and other gold-saving devices located on either side of the screen.

The shaker produces excessive vibration, and to overcome this it is made in two sections, which swing in directly opposite directions so that one counteracts the effect of the other.

The revolving type of screen consists of a large cylinder, usually from four to five feet in diameter and above twenty-five feet in length, made up of sectional steel plates drilled as in the shaker type. The cylinder is slightly inclined toward the rear of the boat and rests in friction rollers. The lower set are so "cut" as to take up part of the end thrust, the remainder being taken up by a vertical roller underneath the lower end. The rotation of the cylinder is produced entirely by these friction rollers, which are driven by steel bevel gears, belts being found very unsatisfactory in this part of the boat, where most of the apparatus is wet. As in the other type, the washing water is supplied through a large perforated pipe passing through the center of the cylinder. The revolving screen has its advantage over the shaking screen

Figure 6.

in the handling of material containing large amounts of clay, for the disintegrating action is better and any gold which sticks to the clay can be more effectively separated. It is also simpler than the shaking screen, in that it does away with the eccentrics necessary to produce the shaking motion. In the latest machines of this type, the plates of the cylinder are made in sections, which are conveniently replaced when worn out.

The tailings from the screen are taken care of by the stacker or conveyor at the stern of the boat. This consists of a long, built up girder supporting a chain of buckets, or an endless belt, depending on the type of stacker, together with the necessary appliances for driving and guiding the conveyor proper. The bucket conveyor consists of a chain of light steel buckets passing over tumblers at either end of the ladder and supported by rollers along its upper side. The belt conveyor consists of a heavy rubber belt from twenty-eight to thirty-six inches in width and half an inch thick. At either end it passes over large rollers and on the upper side of the ladder runs over a combination of inclined rollers which give it a trough shape.

As to the respective merits of the above named devices, the belt causes less occasion for shut down on account of its simplicity, but it is rather short lived, never lasting more than eight or nine months, and is expensive to replace. Also there is a limit to the angle to which it will stack, as at a large angle the coarser material has a tendency to roll back down the belt.

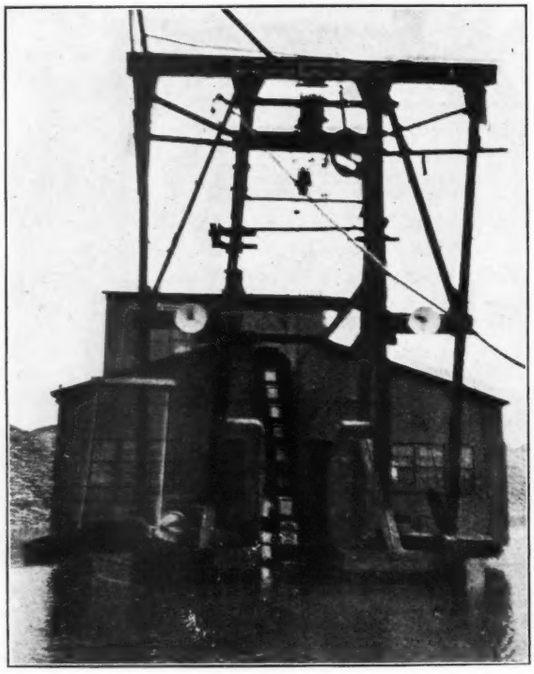


Figure 7.

The buckets will stack at any desirable angle and are much more durable, but they are decidedly more complicated, with many parts to get out of order and cause shut downs for repairs.

The saving of the gold from the screenings becomes a simple placer mining problem, an important item in this case, being the saving of floor space in the construction of the apparatus. In almost every case this consists of riffles in the form of "tables" leading out from either side of the screen and on which the gold is collected in a quicksilver amalgam. A clean-up occurs once a month or during shut downs, and it is found that most of the gold is collected on the first riffles. These tables have a large area and are found to be very efficient, practically all the gold being saved.

The overflow from the tables is carried through sluices to the rear of the boat and emptied into the pond, excepting in close work or where it contains a large quantity of sand. In these cases the sand might interfere with the manipulation of the boat and a sand pump is installed which elevates the sand through a pipe passing up along the conveyor ladder and deposits it over the tailings pile. This sand pump is a great power consumer and is done away with wherever possible.

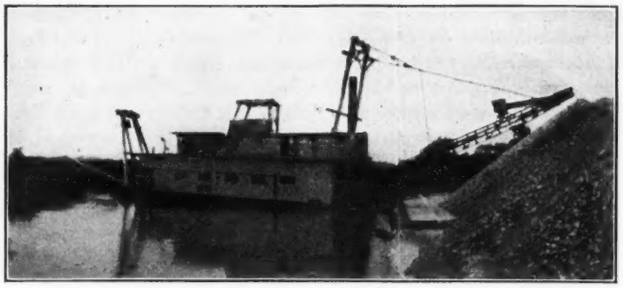


Figure 8.

The kind of power used for operating gold dredges depends on the facilities at hand in the various localities. Where reliable electrical power can be obtained at reasonable rates it is always used.

A steam dredge requires boilers and numerous engines on board, with the attendants necessary to operate them, and is a somewhat complicated machine with a large repair list. The installation of electric motors produced a great saving in floor space and cost of attendance. The boats were built much shorter and became easier to handle. One advantage of a steam driven bucket line is that if it encounters an obstruction the engine slows down with a decreasing torque, while the alternating current induction motor when overloaded to the point of reduced speed gives an increased torque which is liable to produce dangerous strains in the bucket line.

In general the electrical equipment of a dredge consists of the following:

1. A bank of lowering transformers.
2. A variable speed induction motor for driving the bucket line. This is connected to the upper tumbler by a system of belts and gears which reduce the speed the proper amount. In some types this motor is connected by a friction clutch to a winch which raises and lowers the digging ladder.
3. A variable speed motor for driving the various winches for handling the shore lines, stacker and spuds. The controllers for these two motors are located in the operating room, together with the levers controlling the clutches of the various winches.
4. A constant speed motor for operating the stacker line. In the latest types this motor is placed at the upper end of the stacker ladder, where it is connected to the upper tumbler or roller.
5. A constant speed motor or motors for driving the centrifugal pumps which supply water to the hopper and to the screens and tables.
6. A constant speed motor for operating the screens. In some cases this is combined with No. 4.
7. A constant speed motor for driving the sand pump, in case one is used.
8. A small auxiliary motor and pump.

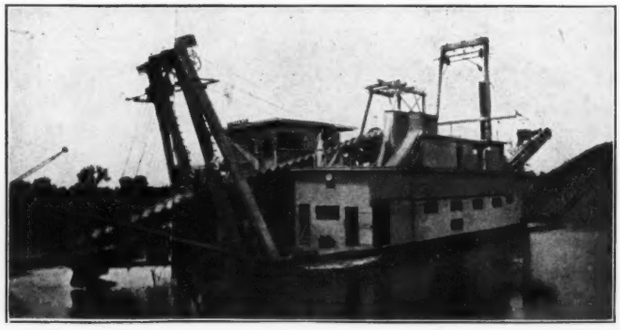


Figure 9.

Power is generally transmitted to the dredge, three phase, 60 cycle, through an insulated cable running from the pole line on the bank and fastened to one of the gantries on board. This cable is subject to much handling and has to be strong and water tight as well as flexible. Most companies now use a regulation armored submarine cable, though some cables in use at the present time and doing good service consist of three No. 2 B. & S. double rubber covered 3-32 inch insulation copper wires drawn into a heavy 1¼ inch rubber

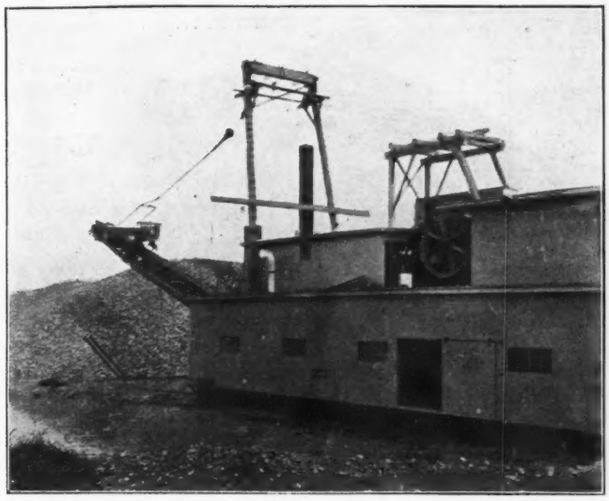


Figure 10.

hose, the joints of which are well cemented. These cables are tested at 10,000 volts.

The majority of the boats at Oroville and Folsom have the transformers on board, but with the excessive vibration that is always present on the dredge, their life cannot be very long, comparatively. Placing the transformers in a small barge at the side of the boat might overcome this objection and decrease the fire risk. Some companies have installed a substation on shore and transmit the power to the boat at the bow voltage through cables supported on floats.

The dredge is operated in three shifts of eight hours each and is lighted throughout by incandescent lamps, arcs being found unsatisfactory, due to the excessive vibration. The cost of power in the Oroville district is one ane one-half cents per kilowatt hour.

The dredgers used in the Oroville and Folsom districts are built by the following companies: Bucyrus Company of South Milwaukee, Wisconsin; Risdon Iron Works of San Francisco; Marion Steam Shovel Company of Marion, Ohio; Link-Belt Machinery Company, Chicago.

Following is the motor equipment of several typical dredgers:

1. A three cu. ft. Risdon boat. One 50 H. P. variable speed for bucket line, screen and stacker; one 30 H. P. for water pump; one 10 H. P. variable speed for winches. Total equipment, 90 H. P.

2. A five cu. ft. Risdon. One 50 H. P. variable speed for main drive; one 40 H. P. for water pump; one 20 H. P. for drum and stacker; one 10 H. P. variable speed for winches; one 10 H. P. for ladder winch. Total equipment, 130 H. P.

3. A three cu. ft. Bucyrus. One 50 H. P. variable speed for main drive; one 20 H. P. variable speed for winches; one 30 H. P. for water pump; one 20 H. P. for stacker and screen; one 30 H. P. for sand pump; one 33 H. P. for auxiliary water supply. Total equipment, 153 H. P.

4. A five cu. ft. Bucyrus. One 75 H. P. variable speed for main drive; one 20 H. P. variable speed for winches; one 20 H. P. for screen and stacker; one 50 H. P. for water pump; one 40 H. P. for sand pump; one 5 H. P. for auxiliary water supply. Total equipment, 210 H. P.

5. A seven cu. ft. Bucyrus (built on Yuba river). One 100 H. P. variable speed for main drive; one 50 H. P. for water pump; one 50 H. P. for sand pump; one 20 H. P. for stacker; one 20 H. P. for shaker; one 30 H. P. variable speed for winches, one 7½ H. P. for auxiliary water supply. Total 277½ H. P.

6. A seven cu. ft. Marion. One 100 H. P. variable speed for bucket line; one 30 H. P. variable speed for ladder; one 50 H. P. variable speed for main pump; one 20 H. P. for screen and stacker; one 20 H. P. variable speed for winches; one 10 H. P. for auxiliary pump. Total, 230 H. P.

The following is a fair average of the consumption of power on different boats:

1. A three cu. ft. Bucyrus. Main drive, 26 to 45 H. P.; stacker and screens, 12 to 16 H. P.; water pump, 45 to 50 H. P.; winches, maximum, 28 H. P.; sand pump, 32 to 50 H. P. Total, 143 to 189 H. P.

2. A five cu. ft. Bucyrus. Main drive, 42 to 72 H. P.; stacker and screens, 10 to 20 H. P.; water pump, 50 to 75 H. P.; winches (maximum), 27 H. P. Total, 129 to 174 H. P.

3. A five cu. ft. Risdon. Main drive, 60 H. P.; water pump, 52 H. P.; screen and stacker 18.5 H. P. Total, 130.5 H. P.

4. The seven cu. ft. Bucyrus. Main drive, 108 H. P.; water pump, 68 H. P.; sand pump, 63 H. P.; stacker, 9 H. P.; shaking screens, 11 H. P.; auxiliary pump, 13 H. P. Total, 272 H. P.

A comparison of these two lists shows that some of the motors are running much below the rated capacity and therefore not at their maximum efficiency. One loss of power often is due to the centrifugal pumps, where the measured efficiency has been found as low as 40 per cent to 50 per cent. This might be materially increased by designing the pump for the conditions under which they are to work. This has not been done satisfactorily in many cases.

The average running time of the boats varies a great deal in different months and under different circumstances, depending on the climatic conditions and the obstacles encountered. The greatest amount of time is lost in repairs. The following is a table of the time lost in repairs on one boat for the year ending December 31, 1904:

Ladder	10.7 per cent
Bucket Line	20.5 per cent.
Stacker	10.7 per cent
Winches	3.5 per cent
Screen	9.9 per cent
Pumps	2.6 per cent
Power	7.9 per cent
Lines	9 per cent
Cleanup	3.5 per cent
Other causes	21.7 per cent
Total lost time	32.8 per cent
Dredging time	67.2 per cent
Average number of cubic yards dredged per day, continuously running	2,005
Actual average number of cubic yards dredged per day of twenty-four hours	1,347

A fair average of the yardage handled by different boats in the Oroville district is given in the following table. These values are from data extending over a long period of time and it will be found that they are very near the actual capacity of the boats:

Three cu. ft. open type bucket line, 25,000 to 35,000 cu. yds. per month.

Five cu. ft. open type bucket line, 35,000 to 45,000 cu. yds. per month.

Three cu. ft. close connected type bucket line, 35,000 to 45,000 cu. yds. per month.

Five cu. ft. close connected type bucket line, 50,000 to 60,000 cu. yds. per month.

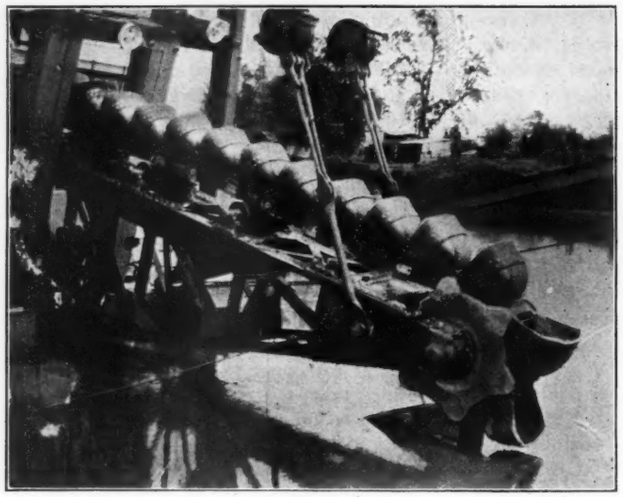


Figure 11.

A general idea of the operating costs of a dredge may be obtained by consulting the following tables taken from the annual report of the Oroville Dredging and Exploration Co. of California for the year ending December 31, 1904:

The figures for the several items of expense in the following tables varied from month to month throughout the year, and the averages for the entire year only are given:

OPERATING AND ALL OTHER COSTS.

	Total for Year.	Total Expense in Cts. per Cu. Yd.
Operating expense Biggs No. 1 and superintendence	$27,832 53	5.62 cents.
General expense, Oroville and San Francisco	1,788 62	.36 "
General plant	1,262 78	.26 "
Bullion expense	251 34	.05 "
Taxes	1,942 66	.39 "
Warehouse	401 18	.08 "
Insurance	450 00	.09 "
Legal	1,070 50	.21 "
Total and averages	$34,999 41	7.06 cents.

DETAILS OF OPERATING COSTS.

	Total for Year.	Per Cent of Total.	Cost Per Cu. Yd.
Labor—			
Operative	$6,435 20	22.9	1.290 cents.
Repair	4,690 41	16.8	.943 "
Superintendence	1,875 00	6.8	.380 "
Power—			
Dredge	4,902 81	17.7	1.000 "
Pumps	68 20	.3	.014 "
Hardware—			
Supplies, Tools, Oils, etc.	1,109 77	4.0	.220 "
Repair parts, etc.	6,768 23	24.4	1.370 "
Freight, express and hauling	504 69	1.8	.100 "
Steel cables	336 03	1.2	.070 "
Lumber	28 06	.1	.006 "
Electric supplies and work	285 67	1.0	.060 "
Clearing ground	794 40	2.9	.160 "
Sundry expenses	34 06	.1	.007 "
Totals and averages	$27,832 53	100.0	5.620 cents.

SUMMARY OF COSTS IN CENTS PER CUBIC YARD.

Year.	Dredge Crew and Power.	Repair Labor.	Repair Supplies	Superintendence	Oroville and S. F. General Expense	Taxes and Insurance	Bullion Expense	Grand Total, All Costs.
1904	2.69	.94	1.61	.38	.36	.48	.05	6.51
For three $45,000 dredges these items would have been as follows:	2.69	.66	1.61	.17	.12	.27	.05	5.57

Our No. 1, or $45,000 dredge, made the following record:

Cubic yards dredged		493,150
Gold yield per cubic yard	12.32 cents.	
Operating costs	5.62 "	
Operating profit	6.70 cents or	$32,905 79
Improvement, taxes, insurance, legal and all other working expenses (except construction of No. 2 dredge)		7,166 88
Surplus		$25.738 91

Our No. 2 or $75,000 dredge should be ready to begin work next month (January, 1905). Figuring on the data now available, the two dredges should make following average annual record:

	Cubic Yards Dredged.	Operating Cost Per Cubic Yard.	Probable Yield Per Cubic Yard.	Surplus.
Dredge No. 1 (first cost, $45,000)	520,000	5.30 cents.	.....	.....
Dredge No. 2 (first cost, $75,000)	780,000	5.00 cents.	.....	.....
Totals and averages	1,300,000	5.12 cents		
Improvements, taxes and all other working expenses		88 cents.	.....	.....
Total		6.00 cents.	9.5 cents.	3.5 cents.

Or a yearly surplus of $45,500. Our prospect information indicates that after rejecting that portion of our land of doubtful value, the property should have a life of from thirteen to fourteen years at the above estimated rate of dredging.

BULLION TABLE.

Month.	Cubic Yards Bank Measurement Dredged	Bullion Yield	Operating Expenses	Yield per Cubic Yard	Operating Cost per Cubic Yard	Operating Profit per Cubic Yard
January	20,340	$3,120.87	$2,677.00	15.38c	13.16c	2.22c
February	32,000	3,408.59	2,205.07	10.65c	6.89c	3.76c
March	41,160	7,732.62	2,418.94	18.78c	5.88c	12.90c
April	50,760	9,600.10	1,854.69	18.91c	3.65c	15.26c
May	47,700	8,072.17	2,233.41	16.94c	4.68c	12.26c
June	40,750	3,704.36	2,013.97	9.09c	4.94c	4.15c
July	44,380	4,271.03	2,272.36	9.62c	5.12c	4.50c
August	39,300	4,273.31	2,471.91	10.87c	6.29c	4.58c
September	41,600	4,265.74	2,392.09	10.25c	5.75c	4.50c
October	48,460	4,645.08	2,620.83	9.58c	5.40c	4.18c
November	40,300	3,374.92	2,340.96	8.37c	5.81c	2.56c
December	46,400	4,269.73	2,331.31	9.20c	5.02c	4.18c
Totals and Averages.	493,150	$60,738.52	$27,832.53	12.32c	5.62c	6.70c

EXTRACTION TABLE.

Month.	Depth in Feet.	Dredged. Acres.	Dredged. Cubic Yards—Bank Measurement	Number Prospect Holes In and Near Area Dredged	Prospect Value of Ground Dredged.	Prospect Value Recovered	Total Gold Recovered in Cents Per Cubic Yard	Operating Costs in Cents Per Cubic Yard	Character of Ground Dredged.
					Cts.	%			
January	32.1	.40	20,340	2	15.35	100.20	15.38	13.16	Coarse gravel to surface; dredging across slough.
February	22.0	.90	32,000	2	15.35	69.57	10.65	6.89	10 feet top soil; 2 feet of gravel on bedrock; hard digging.
March	28.7	.89	41,160	2	37.70	50.00	18.78	5.88	10 feet soil; gravel coarse and hard digging.
April	27.0	1.15	50,760	3	37.70	50.00	18.91	3.65	12 feet top soil; 15 feet coarse gravel; 3 feet on bedrock; hard digging.
May	27.0	1.09	47,700	3	16.25	104.24	16.94	4.68	12 feet top soil; gravel coarse.
June	21.4	1.18	40,750	2	10.35	87.96	9.09	4.94	10 feet soil; gravel firm and sand on north side of cut.
July	22.0	1.25	44,380	2	11.45	84.02	9.62	5.12	4 feet top soil; coarse gravel on west side cut; sand streak on east side.
August	26.0	.93	39,300	2	11.45	94.93	10.87	6.29	6 feet top soil; sand streak on west side of cut; all fine gravel; easy digging.
September	24.2	1.06	41,600	2	4.40	230.00	10.25	5.75	6 feet top soil; sand on west side of cut; all fine gravel; easy digging.
October	23.8	1.27	48,460	3	5.25	182.43	9.58	5.40	6 feet top soil; sand in center of cut; remainder fine gravel; easy digging.
November	31.0	.81	40,300	3	17.23	48.58	8.37	5.81	7 feet top soil; east side cut in sand; remainder of cut fine and coarse gravel.
December	28.8	.92	46,400	3	17.23	53.40	9.20	5.02	7 feet top soil; coarse and fine gravel full width of cut.
Totals and Averages	25.8	11.85	493,150	29	16.64	74%	12.32	5.62	

The prospecting for gold for the purpose of obtaining dredging values is almost universally accomplished by means of Keystone drillers. This machine drills a hole about six and one-half inches in diameter. The casing for the hole is driven ahead of the drill as far as possible and the drill is supposed to cut out the core, the volume of which is determined by the outside diameter of the casing. The contents are brought up by the sand pump, rocked and panned by the

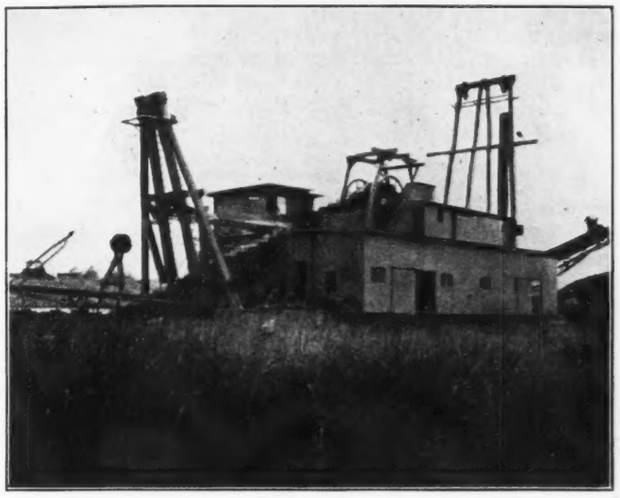


Figure 12.

usual methods, and from the results the value per cubic yard is determined for that particular hole. It seems to be conceded in general practice that the percentage of the prospect value which the dredge will recover, provided the drill holes are numerous enough, varies between 70 per cent and 90 per cent.

In conclusion, it might be well to enumerate the principal features of a good gold dredging property:

First: Paying values in the ground.

Second: Good bed rock which can be cut into and scraped by the buckets.

Third: Depth not exceeding sixty feet below water line. This is the maximum depth of gravel for which dredgers have been constructed.

Fourth: Ground of loose composition, free from clay.

Fifth: Good facilities for power supply.

Sixth: An available supply of water.

Seventh: Favorable climatic conditions.

Eighth: Proper contour of ground surface.

Ninth: Accessibility.

Tenth: Reasonable first cost of land.

Photographs No. 1, No. 2 and No. 3 show the bow of the "El Oro" dredger built by the Link Belt Machinery Company of Chicago. They will illustrate the action of the bucket line on a bank some fifteen feet above the water level. The stream of water flowing into the pond is supplied by a pumping plant and its purpose is to keep the level of the pond from sinking, due to seepage, and also to keep the water sufficiently clear for gold washing purposes. The bucket ladder is seen to be of the box girder type. The buckets are of five cu. ft. capacity and are running comparatively full.

The distinctive feature of this boat is its elaborate equipment. The motors are large and the whole system well arranged. Everything about the boat is controlled from the pilot house, where a marble switchboard containing ammeter, voltmeter and recording wattmeter is installed. The riffle surface is large and it is worthy of notice that the first riffle where most of the gold is collected is caged in and secured with a padlock!

The whole winch equipment is concentrated in one compact collection of drums, all controlled from the pilot house by a system of levers. Another feature is the double compensating thimble gear at the upper tumbler. This last is mounted on a twelve inch hollow shaft, through the center of which the pulley shaft passes, being connected to the large gear wheels on either side through intermediate gears.

These three photographs may also be used to illustrate in a way the operation of the spuds. The two spuds and the digging buckets form the corners of an isosceles triangle. The buckets are working across the face of the cut in No. 1, swinging around the steel spud and gradually advancing the wooden one, which is raised and is on the left or port side. On crossing the cut the boat is swung on out into the pond (No. 2) and the wooden spud dropped while the steel one is raised. On swinging back to the cut the latter is advanced and dropped. Thus the whole boat has been advanced and the buckets cut into the bank (No. 3).

On this boat the steel or working spud is constructed of three parallel I beams with plates connecting them, forming a rectangular beam 24x30 inches and weighing 34,000 pounds. The wooden spud is a piece of Oregon pine two feet square and fifty feet in length. The rear of the spud passages is fitted with heavy coil springs to take up to a certain degree some of the strains. Figures No. 4 and No. 5 show the rear of an old type Risdon boat, the Biggs No. 1, owned by the Oroville Gold and Exploration Company. Figure No. 4 shows the stern gantry and the bucket conveyor. The small housing contains the motor for driving the conveyor and the revolving screen. This screen, along with the gold saving tables and the conveyor buckets is shown in figure No. 5. The bevel gear and friction drive on the screen, together with the spray pipe and the bucket rollers, are well shown.

The power to this boat was supplied through three 50 K. W. Stanley transformers, reducing the 33-phase 4000 volt current to 440 volts, being connected in delta. The bucket line (the new one installed aggregated 64,000 pounds dead weight) is run by a General Electric 50 H. P. variable speed induction motor, Type 1, Class 10, speed 50-720, Amperes 65. A 40 H. P. constant speed motor of the same type is direct connected to the main pump, a double centrifugal with three 8-in. suction pipes and a 13-in. discharge. A 10 H. P. constant speed motor drives the head and side line winches, while a variable speed 10 H. P. motor operates the ladder hoist winch. A 40 H. P. constant speed motor supplies power to the re-

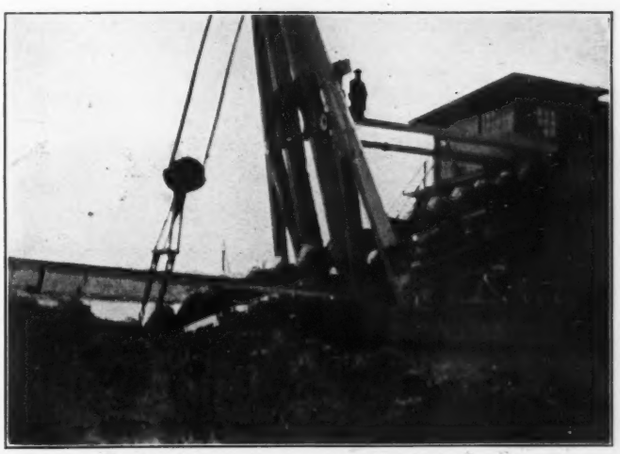


Figure 13.

volving screen and at the same time operates the conveyor from the upper end by means of a rope drive.

This boat uses a 1⅛ in. head line with no spuds and another distinctive feature of this type of boat is that the main and side gantries are built of steel throughout, with a greater first cost, but doing away with tightening of bolts, etc., and the possibility of the bearings getting out of line and causing trouble. The ladder is hoisted by means of a ¾-in. cable

Figure 14.

passing through a system of sheaves which decrease the rope speed (about 100 ft. per sec. maximum) six to one.

The ladder consists of a heavy lattice girder about 3 ft. deep in the center and tapering to each end.

Figures No. 6 and No. 7 are of a more modern Risdon boat, the "Leggett No. 3." The improvements in this over the older boat are the placing of the stacker motor on the outer end of the ladder, making the revolving screen in replaceable sections and using much heavier design in the construction of breakable and wearing parts. Both of these pictures show the suspension of the power cable from the bow gantry. The general practice in handling these cables would seem to be somewhat careless. They are allowed to drag over the ground, being subject to considerable wear and liable to kinks, which are dangerous. Consequently they are not very long lived. This cable is about 500 feet long and cost $175.00

Figure No. 7 shows the Risdon open connected bucket line, which is running at the rate of about thirteen buckets per minute. The operating room in this type is on the lower floor, just to the right of the bucket line in the picture. At the time the photograph was taken the boat was digging to a depth of thirty feet and covering about thirteen acres a year.

A noticeable feature is the noise and jar caused by the upper tumbler, which is four sided. It is difficult to keep your balance on first boarding the boat, and the excessive vibration is indicated by the blurred outlines in the picture

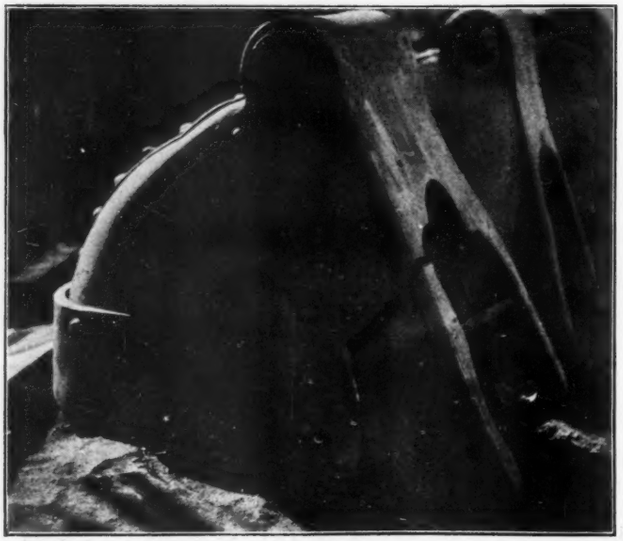


Figure 15.

Figure 7. It will also be noticed that the bucket line is not running up the middle of the ladder rollers, but is curved to the right midway up the ladder. The exceptional wear on the cutting edges of buckets is illustrated by the fact that the lip of one of these buckets, being 1 in. thick and 7 in. wide, was worn down 4 inches during a 13 months' run.

Figures 8, 9, 10 and 11 are views of the latest boat in the district, a new $75,000 Bucyrus boat, operated by the Oroville Gold and Exploration Company and named the "Biggs No. 2." It has been in operation since February, 1905, and probably represents the highest development at that time in the matter of a gold dredge. It is a five cu. ft. boat, dumping about 22 buckets per minute and has averaged 3300 cu. yds per day for a short period of time, and should average annually 65,000 cu. yds. per month. Its electrical equipment is as follows:

Three 75 K. W. Westinghouse transformers.

One 75 H. P. variable speed Westinghouse motor for main drive.

One 50 H. P. Constant speed motor to drive the double 8-in. centrifugal pump.

One 20 H. P. motor to drive the shaking screens with which this boat is fitted.

One 20 H. P. variable speed for winches.

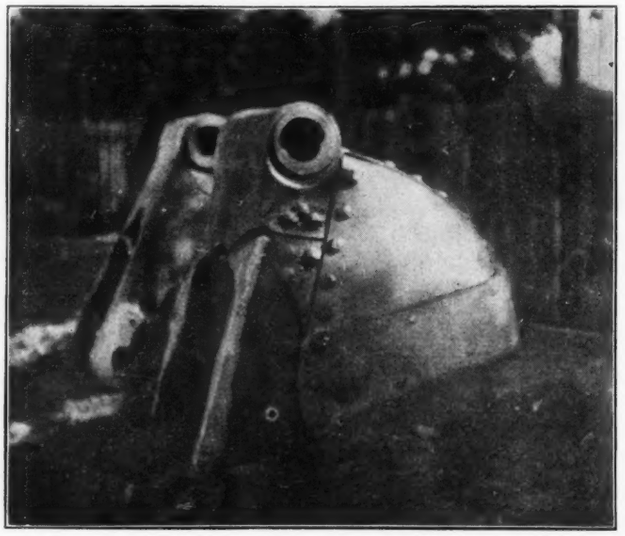


Figure 16.

One 20 H. P. for stacker located at the upper end of the ladder. (See print No. 10).

One 5 H. P. for auxiliary water supply.

The bucket line, of which an excellent view is given in Figure No. 11, consists of 78 close connected buckets. The make up of the buckets, as well as the manner of connecting them, is well illustrated. These bucket lines are in use on three or four of the Risdon boats, while one Bucyrus boat uses the Risdon revolving screen. The tumbler is seen to be hexagonal and is fitted throughout with manganese steel wearing plates, one of which was discovered to be broken off. The ladder is a heavy truss all the parts being riveted together by means of plates covering the joints. The rollers are extra large and are cast hollow. It will be noticed that the ladder is hung from as near the end as possible, so as to give the maximum lifting leverage.

The wooden spud is seen in its raised position. It is a single piece of Oregon pine 30x24 inches. The steel spud is of the same construction as that on the Link-Belt boat and weighs 20,000 pounds. The conveyor is of the belt type, the belt being 30 in. wide by ½ in. thick and costing about $7 per running foot. It runs at a linear velocity of 380 ft. per min. The outside system of incandescent lighting may also be seen in these pictures. The operating room is located in the pilot house, as in the Link-Belt boat.

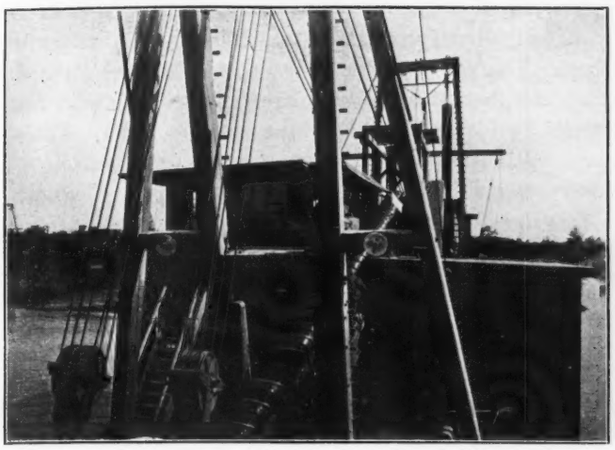


Figure 17. A Well Designed Bucket Line.

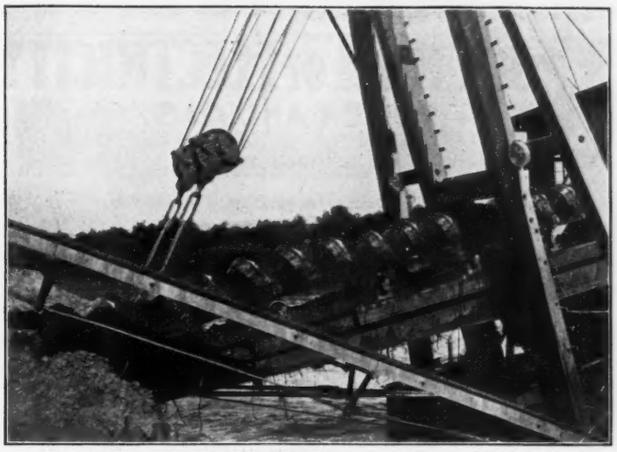


Fig 18. Well Filled Buckets Doing Their Work.

Figures 12, 13 and 14 illustrate a seven cubic foot boat, known as the "Boston and California No. 3," built by the Marion Steam Shovel Company of Marion, Ohio. This boat has been recently constructed and is probably one of the first successful dredgers built by this company in this district. It has all the latest improvements, but with several distinctive features, viz., the screen is of the revolving type, but is made in three cylindrical sections of different diameters placed together in the shape of an open telescope with the smaller end under the hopper. Also the belt on the conveyor was not troughed appreciably, but had guides along the edges for the entire length. At the time visited this boat was digging surface material in very marshy ground. The buckets carried up very muddy, sticky material, which clogged the hopper during almost every cut. The only remedy was to shut down and let two men, one down in the hopper and the other in the upper end of the screen, take pick and shovel and remove the mud. It was also noticed that none of the buckets dumped even 50 per cent of their load, and some of them none whatever, but carried it back into the well. This possibly might have been remedied by allowing a stream of water to play into the buckets as they turned over the tumbler, as is done on some of the Bucyrus boats.

The buckets dump at the rate of twenty-two per min. and are driven by a variable speed 100 H. P. motor. The boat is equipped with Westinghouse **variable** speed motors and General Electric **constant** speed motors.

Figure No. 14 shows the comparative size of three seven cu. ft. Marion buckets. Figures 15 and 16 are views taken of old style buckets that have given way to strains too great for the material of which they were constructed.

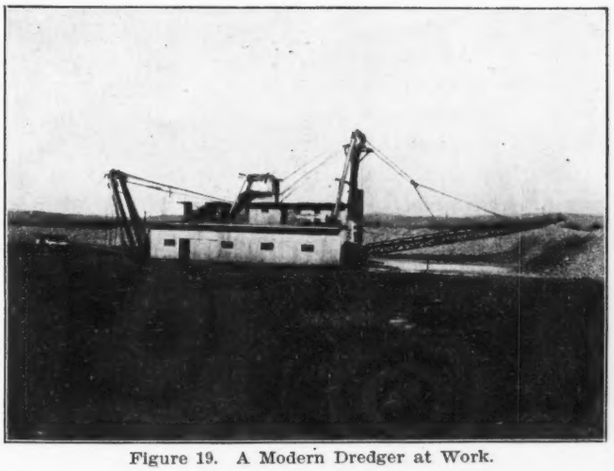


Figure 19. A Modern Dredger at Work.

Figure 20. One of the Latest Dredgers in the Oroville District.

Figure 21 A Risdon Rotating Screen and Stocker.

Figure 22. A Large Dredger at Work.

The JOURNAL of ELECTRICITY POWER AND GAS
The Engineers' Architects' and Builders' News

Published Weekly by

The Journal of Electricity Publishing Company

701 Atlas Building, San Francisco.

Yearly subscription, $2.50. Single copies, 10 cts. Foreign subscription, $3.50 Subscriptions cannot be begun with back numbers. Manuscripts submitted must be accompanied by postage to insure return.

Address all communications and make all remittances payable to the Journal of Electricity Publishing Company.

EASTERN AGENCIES:

NEW YORK.....
CHICAGO.....257 Monadnock Block
ST. LOUIS.....

H. B. KING, Eastern Mgr of Advertising

WESTERN AGENCIES:

LOS ANGELES.....
PORTLAND.....
SEATTLE.....

W. A. DOUGLASS, Western Mgr. of Advertising

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," with which is incorporated "The Engineers' Architects' and Builders' News."
Entered as second-class matter at the San Francisco Post Office, August 15, 1899.
Entered as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.

VOL. XVII JULY 21, 1906 No. 3

EDITORIAL.

THE PRINCIPLES INVOLVED IN THE COMMERCIALLY SUCCESSFUL OPERATION OF GOLD DREDGING.

The problem of extracting the free gold from the gravel beds in various parts of the world has been carried on for a great many years by hand labor and by a simple device known as a cradle. In this case the gold was mined by hand shovels and separated from the gravel by panning and by use of the cradle. The operation of the gold dredge is practically the same scheme on a large scale, handling very large quantities of gravel per day, and hence successful in working very low grade material.

In the gravel beds the gold is found distributed through the mass of gravel and sand, but due to its specific gravity, the richer deposits are at bed rock, and hence the function of the dredge is to handle the gold bearing gravel successfully, separate the gold from the gravel and thoroughly scour the bed rock where the richer material is found. The scraping off of the bed rock is the most important feature in the operation of the dredge, and hence it can be seen that a suitable bucket device must be used, not only one that will excavate the upper levels of the deposits, but entirely remove all gold and gold-bearing gravel from the bed rock. Experience has shown that the best method of attaining this end is the operating of a number of buckets on a chain, which is supported on an arm called the "ladder."

The essential parts of a dredge are the bucket line, separating screens, riffles for catching the gold and stacker, and a failure in operation of any one of these parts immediately causes a "shut down" in the whole plant. The foregoing is a list of the essential parts, but a number of auxiliaries are required to effect the proper handling and separation of the gold. These parts, although auxiliary, are very necessary to successful operation.

Due to the great weight of the equipment of a dredging machine, it has been advisable to build the dredge in the form of a boat or barge, which is constructed in a rectangular form and floated in a pond of water. This allows the raising or lowering of the entire machine by changing the level of the water in the excavation, dredges having been made to work successfully in this way to depths of 60 feet below the surface of the ground. Another advantage of having the dredge floating is in the case of directing the cut that the bucket line takes. An enormous amount of power would be required to accomplish this if the dredge were operated on the surface of the ground, on tracks, and a great waste of time would be required to change the position of the machine. Hence, the only successful method of operation is that of floating the entire machine.

The area of the pond remains fairly constant as the material excavated at the bow of the boat is deposited at the stern. The auxiliary parts comprise the handling gear for directing the cut, the pumps for furnishing the water for washing the gravel, etc. Most of the gold dredging machines in this part of the country are operated by electric power and hence there should be added to the list of equipment, the necessary motors, controlling devices, and transformers if the high tension side of the line is brought directly into the dredge. Dredges are either operated by steam or electric power, but the most economical appears to be by electric power, especially where it can be obtained from an hydro-electric plant. By the use of electric power, the weight of the installation is much less than if steam were used, the mode of operation much simpler, and also a great saving of space results.

Since when a dredge is shut down for repairs its productive value ceases and its cost of maintenance continues, except the cost of power, it is important to eliminate as much as possible all stoppages, or rather reduce them to a minimum. This has been accomplished by diligent study and experiment resulting in the designing of the parts as nearly as possible in accordance with the load to which they are subjected. But this load is almost indeterminate, as, for instance, when the bucket engages under a large boulder or shelf of bed rock. The enormous strains that take place in such a case can hardly be computed and only an idea of their magnitude can be realized by the results that take place, such as shearing the pins in the bucket line or the tearing off of a bucket. Absolute necessity and bitter experience joined together are the two agents that have developed the proper materials of which to construct the various parts and it is a great credit to the engineers who have been operating and designing

dredgers during the past few years that the remarkable improvements which they have made in the entire machinery of the dredge has resulted in a large saving in the cost of operation, due to the reduction in the amount of time lost on account of "shut downs" necessitated by repairs.

The wise dredge manager keeps on hand a number of spare parts, particularly those that must come from the East, and also has at hand a well-equipped machine shop, so that the least possible time is lost in replacing a broken part of the dredge machinery.

THE JOHN W. MACKEY, Jr. PROFESSORSHIP OF ELECTRICAL ENGINEERING AT THE UNIVERSITY OF CALIFORNIA.

Mrs. John W. Mackey and Clarence H. Mackey, her son, have endowed the chair of Electrical Engineering in the University of California, in Berkeley, by presenting to the University $100,000 to found the John W. Mackey, Jr., Professorship of Electrical Engineering, in memory of Mrs. Mackey's son and Clarence Mackey's brother, John W. Mackey, Jr.

In a letter to President Wheeler, under date of July 5th, enclosing Mrs. Mackey's check for $50,000 and bonds of a market value of $50,000 from Mr. Clarence Mackey, the latter expresses the desire of the donors as to the use of the endowment in the following words:

"My idea is that the gift of $100,000, from my mother and myself, take the form of the foundation of the John W. Mackey, Jr., Professorship of Electrical Engineering, with the understanding that the Regents apply the annual income, in whole or in part, according to their judgment, to the salary of the incumbent of the chair, and expend any balance in the equipment and maintenance of the work connected therewith, the original fund to be kept intact in perpetuity."

The income from this endowment will give the Department of Electrical Engineering at the State University assistance which can hardly be overestimated. The income will assure additional equipment and resources, which for the most part will undoubtedly be utilized for experimental and research work in Electrical Engineering.

It is announced at the University that Professor C. L. Cory, who is at the present time Professor of Electrical Engineering and Dean of the College of Mechanics, which college embraces the courses in Steam Engineering, Hydraulic Engineering and Electrical Engineering, will be the first to fill the John W. Mackey, Jr., Professorship of Electrical Engineering at Berkeley.

BOOK REVIEW.

"The Fundamental Principles of Gas Engines and Gas Producers" in the Transactions, No. 10, of the New York Electrical Society, contains the results of the investigations of the writer, Mr. Robt. T. Lozier, on gas engines and producers. The paper is a very clear and concise exposition of the subject, well illustrated, and contains a number of tables showing the analysis of commercial gases, as well as the heat values and the component parts of producer gas.

Trade Catalogues.

The General Electric Co. have issued an exceedingly attractive book containing a description of their new types of electric radiators. Their new Luminous Radiators consist of an ornamental cast-iron frame fitted with a polished copper reflector at the back, and with three or more large cylindrical incandescent lamps. These "lamps" differ from the ordinary incandescent lamps for lighting, being specially designed to transform the electrical energy into heat, which is accompanied by a cheerful glow. When the Luminous Radiator is used in the smoking room or sitting room, there results all the benefits of an open fire, with none of its drawbacks or inconveniences.

The Cartridge Unit Type of Non-Luminous Air Heaters is also described and illustrated. These heaters may be called "Air Heaters" or "Convectors," as distinguished from radiators, and their action depends upon establishing warm air currents in the room, and are, therefore, better adapted for space heating.

The Cartridge Unit is a coil of edgewise wound resistance ribbon, cemented together with an insulating compound, all of which is wrapped in a sheet of mica and slipped into a cylindrical metal shell. The connections are brought through a porcelain insulating plug, spun into one end of the shell, and so designed that it will run at a low red heat indefinitely.

General Electric Bulletin No. 4439 gives a complete description of their GEA-605-A alternating current railway motor. This motor is rated at 75 H. P. and has been built especially for interurban work.

Their Bulletin No. 4440 gives an interesting description of their new type 25 K. W. Curtis steam turbine generator.

Westinghouse circular No. 1132 is of particular value to those interested in protective apparatus against lightning. Two distinct types of protection are employed by this company, one being for low tension distribution for alternating and direct current, and the other for high tension alternating power transmission systems. Details are given of methods of connection, and also the construction of both kinds of equipment, including the location of choke coils, static interrupters and details of ground connections.

The Engineering Department, Bulletin No. 3, of H. M. Byllesby & Co., Engineers, 171 La Salle St., Chicago, is a complete description of the car storage and repair shops of the Fort Smith, Arkansas, Light and Traction Company. The entire arrangement of the plant and details of construction are set forth, including all interesting details.

The Electric Storage Battery Co.'s Bulletins Nos. 99 and 100 are particularly applicable to railway engineers. The former is filled with information regarding the use of storage batteries for electric signals and interlocking switches, while the latter is confined to the use of storage batteries for the electric lighting of steam railway cars.

PERSONAL.

Mr T. E. Bibbins, the genial sales manager on the Coast of the General Electric Company, has gone East on a business trip.

TELEPHONE PATENTS IN 1905.

A patent every day for the year 1905 is the telephone record. During the last year there were issued three hundred and sixty-five patents for inventions relating to telephony, or an average of one daily. This represents thirty per cent increase over the year 1904 and nearly 100 per cent increase over 1903.

INDUSTRIAL.

NEW YORK CENTRAL ELECTRIC LOCOMOTIVE AT ATLANTIC CITY.

One of the 100-ton electric locomotives which the General Electric Company and the American Locomotive Company are furnishing for the electrification of the New York Central Lines in New York City arrived in Atlantic City, June 8th from Schenectady, N. Y. During the attendance this month at various electrical and railroad conventions, prominent officials from all parts of the country will have an opportunity to inspect the locomotive. Its capacity under ordinary working conditions is 2200 horsepower and it is said to be able to develop a speed of 80 miles an hour when in regular operation. It is the most powerful electric locomotive in the world. The locomotive is the same type as the famous "6000" which has so many times distanced its steam competitor while working out on the test tracks on the New York Central road near Schenectady, but bears on its side the number 3404 and the inscription "New York Central Lines."

The locomotive is attracting much attention at the Pennsylvania sidetrack, where it is in charge of representatives of the two companies which have been co-operating in its manufacture. The electric locomotive is primarily on the ground to serve as an actual example of what the railway master mechanics will encounter in the daily work within a very few years. The annual convention of the Master Car Builders and Railroad Master Mechanics is to be in session here during the next two weeks. It was for this occasion that the electric locomotive was shipped from Schenectady, and its early arrival was very timely and of considerable interest to the electrical fraternity in town.

WESTINGHOUSE ELECTRIC AND MFG. CO.'S ANNOUNCEMENT.

We beg to advise our many friends in particular and the public in general that on and after July 18th our entire office force will be located at the corner of Second and Howard streets, San Francisco. All communications to this company should be addressed to that place. Our telephone numbers are Temporary 1658 and 1659. Yours truly,

W. W. BRIGGS, Manager.

HUNT, MIRK & CO.

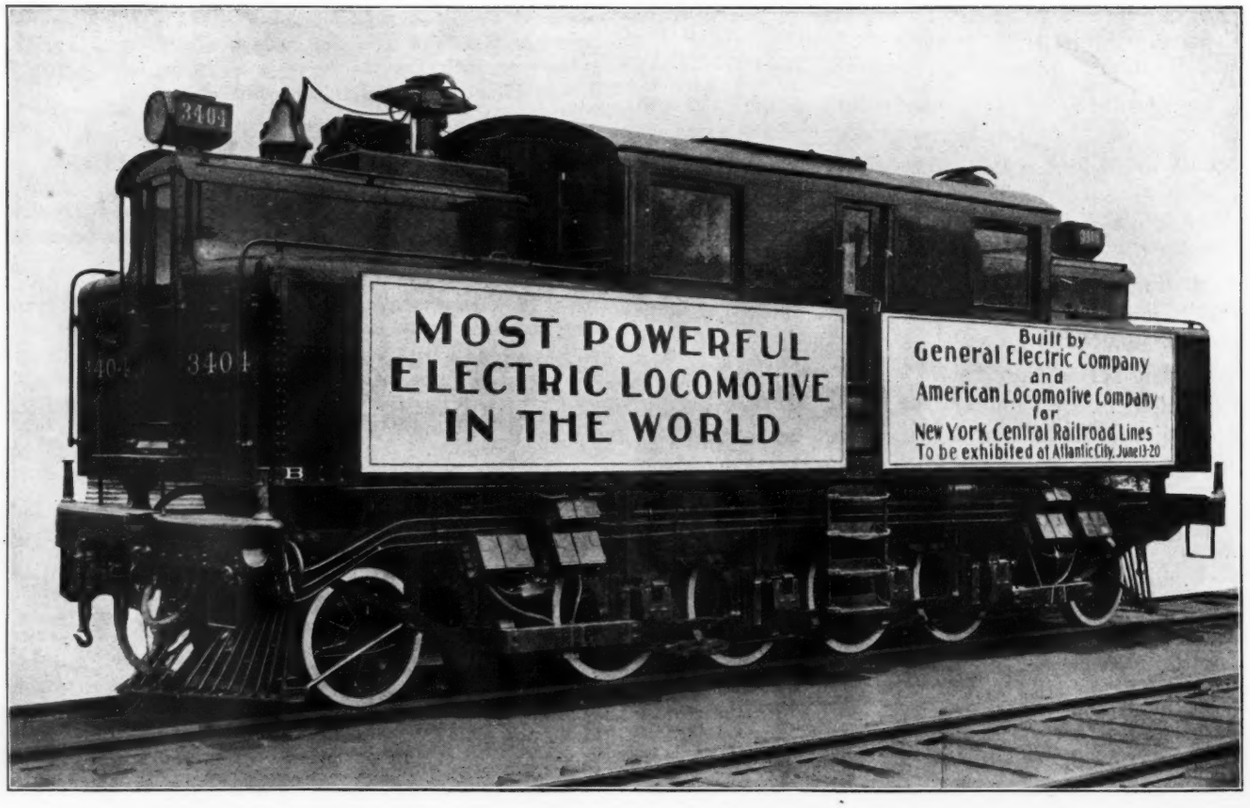
Hunt, Mirk & Co., Inc., are busy at the present time installing Westinghouse-Parsons turbo-generator plants.

The 7500 K. W. turbo-alternator for the Los Angeles Edison Co. has been delivered, and it is now being erected. It is expected that this machine will be in service about September 1st, and its performance will be watched very closely by the engineers of the Coast, owing to the unusual size of the unit, which is several times larger than any steam-driven unit in operation west of the Rocky Mountains. The 24,000 square foot surface condenser, which they are installing with this unit, is unusual in size.

A 2750 K. W. turbo-alternator is being installed for the Los Angeles Pacific Co., and should be in operation about the same time.

The installation of a 1000 K. W. turbine for the San Diego Electric Railway has just been completed, driving two 500 K. W. direct current railway generators. Direct current turbo-generators of this size are unusual, and the eminently successful operation of the machine proves the wisdom of its selection by the officers of that company.

A 500 K. W. turbo-alternator has been delivered to the



North Mountain Power Co. of Eureka, and will be placed in operation as soon as the auxiliary apparatus arrives.

The installation of complete power plants for the Mt. Whitney Power Co. at Visalia and for the North Shore Railroad at Alta is being rushed, and both plants will be in operation within thirty days. The latter plant contains a direct current railway machine, a duplicate of the one installed in San Diego.

The first turbine which the California Powder Works started, a little over a year ago, has proven so satisfactory in every way that they have recently ordered a second unit. This is the first "repeat" order for a Westinghouse-Parsons turbine from the Pacific Coast, and marks another step in their introduction in this section.

The Crocker-Wheeler Company of Ampere, New Jersey, have established their San Francisco office with the Abner Doble Company, at 206 First street.

The Stanley G. I. Electric Mfg. Company has opened a sales office under the management of C. A. Mann, 822 New York Life Building, Omaha, Nebraska.

Woodin & Little are now located in their new building, 534-536 Mission street, San Francisco, with a full line of pumps for all purposes. Their stock is as complete as before the fire, and they are in a position to supply the trade as heretofore.

The National Conduit and Cable Co. have removed their offices from 708 San Pablo avenue, Oakland, to 703 Monadnock Building, San Francisco.

The Wagner Electric Co. of St. Louis, Mo., have just issued a very novel and attractive little ad in an invitation to the National Contractors' Association meeting at Cleveland, Ohio, enclosing what at first glance appears to be a round trip ticket, but upon closer investigation one finds a very clever dissertation on Wagner wares.

Century-Klein Company have removed their supply department and offices from Oakland and are now located at No. 623 Sansome street, as they very aptly state it in their advertisement "Home Again."

Home and Foreign News.

WIRE TRUST IN BELGIUM.

Consul McNally, of Liege, says that five of the largest wire manufacturers of Belgium have entered into a syndicate agreement to control the markets of Belgium and Holland. Quite recently their sphere of action has been extended to include the European countries by reason of a failure to reach an agreement with the German manufacturers, because of their demand of the lion share of the orders. This agreement is subscribed to by the five manufacturers, and a violation of any of its covenants is met with a fine of $10,000. It is said that all orders received are forwarded to the syndicate's principal office, at which place the orders are divided. The agreement is to remain in force and effect for three years unless the same is abrogated by a majority of the contracting parties. The competition with the German makers is keen. It is said that the German manufacturers receive from the Government a sort of subsidy on all orders intended for export, and that with this assistance they are enabled to cut under the ruling price in foreign markets. It is thought that this trust agreement will not be long lived.

ELECTRICAL RAILWAY EXPERIMENTS IN SWEDEN.

The Swedish Government appropriated $115,000 some time ago for the purpose of carrying out electric railway experiments on two short lines near Stockholm, the eventual object being the electrification of the Swedish State Railways The first trial trips were made last June, but as the experiments are to continue during the year 1906, little can yet be said regarding the results.

The experiments are to be confined to single-phase work, preliminary investigation having shown that this would be better under the Swedish conditions than three-phase. The reasons given for deciding upon the former type were the great distances between stations, giving a lower cost of installation on account of using only one wire, the single-phase hydro-electric stations, the possibility of using a higher trolley voltage and the fact that commutator motors could be regulated with greater nicety for varying traffic conditions A further reason given was that the single-phase apparatus had been developed to a more practical stage than three-phase railway apparatus.

LIGHT ON MORMONISM.

The people of the Mormon colony established in Juarez, Mexico, in the State of Chihuahua, have organized to put in an electric lighting plant. The electricity is to be generated by water power and the machinery is said to have been already ordered.

The Mormon settlers in that State are models of enterprise and progress.

ELECTRIC SIGNS.

An effective method of advertising adopted by the Topeka Edison Company has been a form of portable electric sign, which is placed on one of the company's poles. The location of these signs is changed every few days. They are usually placed in residential sections, and the novelty of an electric sign in such a neighborhood never fails to attract attention. These signs are made cylindrical in form to fit around a pole, being split and hinged in the middle to facilitate the work of adjusting and removing them. Besides these portable signs a number of large permanent electric signs have been placedon the tops of buildings in the business district. The wording of some of these is as follows:

Light up. The price is right

A contract signed will increase your sales.

Your success depends on electric light.

Edison light means success. Use it.

Get ready. Christmas is coming. Edison light.

Put in Edison light for the holidays.

On the portable signs for the residential section other wording is used appealing more directly to the householder, such as: "Edison light will not explode."

On a circular mailed to householders the following appeared:

EDISON LIGHT BEAUTIFIES THE HOME.

No work—it's clean. No worry—can't explode. No fumes—just light. No soot—can't smoke. No odor—it's healthy. No headache—it's steady. No matches—it's safe. No heat—it's cool. No danger—it's safe.

STEAM TURBINES RUN FROM EXHAUST STEAM OF RECIPROCATING ENGINES.

Considerable interest, says "Power," has been occasioned by the description, which appeared in our last issue, of a station at Scranton, Pa., in which a steam turbine is run by the exhaust steam of reciprocating units. The same thing is being done at the Thirteenth street station of the Philadelphia Rapid Transit Company, and the results of the two experiments will be eagerly awaited by engineers and engine builders.

The reciprocating engines discharge more steam than the turbine can use, the turbine is simply shunted upon their exhaust line and their freedom of exhaust is in no way retarded. The reciprocating engines would never know that the turbine was there or whether it was running or not. The turbine runs up to the right speed and gets its generator into step. It needs no governor. If it tries to go faster it will automatically take on more of the load and slow itself down. This is a safe method of feeling the way.

Now shall we see a station with a high enough working pressure to warrant non-condensing compounds, with turbines for the third stage, with moderate initial superheat for the reciprocating engines and a considerable degree of reheat before the steam goes to the turbines?

AN AIR ENGINE.

Arrangements are now being made, says the London correspondent of the Los Angeles Times, to test a new type of engine, which, if it proves successful, may cause greater industrial revolution than that which resulted from the discovery of the steam engine or of the application of electricity to motive power.

The patentee is a Lankershireman, who has already achieved some success as an inventor. This new production he describes as a triple economic air engine and if the inventor can justify all his claims the business of the coal miner will be practically gone as far as industrial requirements are concerned.

Summarized, the claims for the new engine are as follows: The economic air engine will save the use of coal and all cost of fuel; it will take the place of steam, which will not be required to keep the pressure of air constant; it will drive a locomotive, propel a ship, work a mill, forge and other machinery without using either gas, water, coal, electricity or oil, and it will entirely prevent smoke.

MUSIC BY TELEHONE.

A score of electrical engineers, journalists, bankers and others interested in the remarkable new invention "Telharmony," of Dr. Thaddeus Cahill, recently went to Holyoke, Mass., by special car to see the apparatus and hear a concert of instrumental music rendered by the Telharmony machine. Among the party were Gen. Engene Griffin, Prof. Richards of Columbia University, Mr. E. E. Higgins, publisher of Success; Mr. H. S. Collette, Secretary J. G. White Co.; Mr. J. W. Middendorf of the Baltimore banking house, and Messrs. Oscar T. Crosby, F. C. Todd, T. C. Martin, G. H. Guy. The apparatus was first inspected at the water-power factory and the music heard there. An elaborate concert was then given at the Hamilton Hotel, two miles away, where the receiving telephone was installed in the ball room, a chamber capable of accommodating three or four hundred people. The keyboard at the factory was played by three performers in succession, and one or two duets were given, the music being classical, operatic, popular and ragtime. The machine furnishing the currents has been built for New York and is to be set up in that city in May. An interesting feature of this notable performance was the fact that about 400 telephones were in circuit at the same time, to illustrate the facility of distribution, but were "choked" in sand, as the one receiver, consuming three watts, was all the auditors needed to deliver to them sweet sounds from the distant "music distillery."

MACHINERY FOR SOUTH AFRICA.

Three two-phase alternators—the largest of their kind ever yet built—the first of which has just been successfully tested, says the Engineering Times, London, are being constructed at the Stafford Works. They are for the Johannesburg Corporation's electric light and tramway installation. The gas-producer plant, by which they and five dynamos will be operated, is the largest up to the present erected anywhere in the world. This plant consists of eight of the largest gas engines, respectively five of 2000 b.h.p. each, driving a 1350-kw. direct-current dynamo, and three of 1000 b.h.p. each, driving a two-phase alternator. One alternator, just completed and dispatched, will form one set of 1000 h.p., which, with two sets of 2000 h.p., will, it is expected, be completed and in operation by April. The gas-producer plant will consist of ten units, arranged in two rows of five and fed overhead by a belt conveyor. Steam is taken from a sliding generator alongside each producer, and forced by blowers into the producer, the generated gas being cooled in twenty 30-ft. high coolers. The gas is fed to the engines under a pressure of 6 pounds per square inch. Each of the two rows of producers is treated as a separate unit, serving a separate gas main and provided with a separate gas washer, scrubber, cooling apparatus, etc. Four electric water-circulating pumps will be installed for utilizing the waste water and removing foreign matters. The plant is unique, not only for its size, but from the fact that it will give an efficiency of 40 per cent of the fuel consumed, as against 22 per cent of the best performance hitherto of gas engines and 11 per cent to 15 per cent of steam engines.

INCREASED DEMAND FOR COPPER.

The following extract is taken from an article entitled "Copper, the Electric Metal," by Charles H. Cochrane, in a recent issue of Moody's Magazine:

The period from 1888 to 1902 marked our greatest growth in electric railways. During those years, with the continuous demand for heavy wires for the trolleys and for feeders, the United States copper production increased from 100,000 to 300,000 tons a year. Hardly did the street railways secure a sufficient supply of copper than the lighting interests demanded more and more, and the call for copper for dynamos and motors and wire to connect them increased with every year. Latterly the long distance telephone business has been making heavy demands for copper wire; and now, in this year of grace, 1906, when we already want more copper than we produce, word comes that the great trunk line railways are about to electrify, and it paralyzes the statistician to calculate how much copper they will require in the next ten years, in the process of overturning methods of long-distance railway haulage.

Foreign countries also call for more copper than they can mine. They have purchased of us regularly for years, taking nearly half of our copper, until last year the home demand cut down the exports materially, with the single exception of China, which kept on buying regardless of the increased cost. If China is to have electric railways and electric light and power, and is relying on us for copper, here is another demand that will be hard to supply. The condition will perhaps stimulate the copper mines of Japan, which are promising, although the insular demand for the metal also increases rapidly. Since Africa has launched a series of railway projects that bid fair to equal our own long lines in a generation hence, and since these lines, in the very nature of modern progress, must be largely electrical, it follows that the demand for the gleaming metal will be world-wide. Then, where is all the copper to come from?

AN ELECTRIC MUSIC-GENERATING DEVICE.

One of the most interesting applications of electricity which it has been our pleasure to record recently, says the Electrical World, is found in the Cahill electric music-generating system.

Broadly considered, this music-generating system differs from previous systems of producing music in that it is purely electrical. Heretofore music has been produced by strings, reeds or pipes, which set the air in vibration. In some cases these vibrations of the air have been copied by a microphone and transmitted electrically to one or more telephones at a distance. But in all such systems of copying music electrically at a distance serious difficulties have developed. In the first place the vibrations of the air initiated by a violin, piano or organ are of but little power. A small fraction of this feeble power only is available to actuate the microphone. The microphone, as every one knows, has serious limitations. It magnifies feeble sounds, but is unable to magnify a loud sound. Further, the various transformations involved, first in changing the vibrations of the air into vibrations of the microphone diaphragm, then in producing from this diaphragm variations of the battery current; thirdly, in producing by induction from these variations in the primary corresponding vibrations in the secondary or line circuit, which (fourthly) in turn produce variations in the strength of the field of the receiving magnet at a distant point, which latter variations produce in their turn the vibrations of the receiving diaphragm and of the air—these many transformations result in a distortion of wave shape, which commonly entails serious injury to the musical beauty of the sound. Moreover, apart from any question of distorted waves and altered qualities, the sounds transmitted by microphones are feeble, so that it is usually necessary to hold the receiver to the ear—a condition which interferes seriously with musical enjoyment.

But in the system of generation invented and developed by Dr. Cahill, electrical vibrations are produced to initiate the sounds, which are as loud at each receiving station as if an orchestra were on the spot. A battery of alternators of different frequencies is used, answering in a general way to the strings of a piano or the pipes of an organ. One or more performers play upon piano keyboards. The keys of these operate switches so as to bring the several alternators into action on the lines or mains as required. Across these mains receiving telephones are connected, just as incandescent lamps are in the Edison lighting system. With each receiving telephone a large paper horn is used. The net result of the system is that instead of the feeble vibrations of the air acting upon a microphone, and thus through numerous transformations as above detailed upon the receiving telephone, the performer is enabled to bring to bear upon the line the full power of a large alternator, or of a group of such alternators. These alternators are specially constructed so as to produce sounds whose purity and musical beauty exceed the finest pipe and closely approach a good string tone.

OIL ENGINES IN PALESTINE.

A paragraph has also come to hand to the effect that oil engines are now used in numbers in Palestine for pumping water from wells. The first attempt at introducing the engines there for that purpose is said to have been made about three years ago by a German firm, the engines being small ones of three or four H. P. At first no one would try them, but finally the agent of the firm in question volunteered in one case to set up an engine free of expense by way of experiment, and this little installation worked so well that it quickly led to the placing of several orders for more. Since then about sixty oil engines have been set up in different places, practically all for plantation work, about two-thirds of the engines having come from Germany and the others from British makers.

A WIRELESS TORPEDO BOAT.

An engine of death, the wireless torpedo boat, which will in all probability revolutionize the navies of the world and make the extended coast line of the United States impregnable from attack by a foreign foe in time of war is the invention of Charles E. Alden, the well-known New York sculptor, but who is now experimenting at his summer home at Cottage City, on the island of Martha's Vineyard.

A boat without a crew, handled from the shore by a mysterious apparatus, the work of the inventor, and doing everything that the latest improved type of torpedo boat is capable of as far as the eye can see from shore, has been successfully operated by Mr. Alden.

Obedient to the Hertzian waves used in the different systems of wireless telegraphy, this boat weighs its own anchor, blows its own whistle, starts its propeller, turns to starboard or port or keeps a straight course ahead, turns on its searchlight, fires a cannon in its bow, drops and hoists its anchor, stops, backs and goes ahead again, lights signals and discharges a torpedo from its tubes. Such are the things Mr. Alden's boat has accomplished.

The device of Mr. Alden is comparatively simple. By putting the several forces of wireless telegraphy together he can stand on the shore with his transmitting apparatus, launch this engine of death, and, with a touch here and there on his instrument, like working a typewriter, transmit electric impulses through the ether and by ether alone to the torpedo boat.

TELEPHONE REGULATION IN BRITISH COLUMBIA

It may be interesting to learn of proposed legislation in British Columbia for the regulation of telephone companies in that province. A bill has been introduced in the Legislature which gives to every person, association or company operating a telephone line the right to connect with the line of any public company, and such public company is to be obliged to receive and transmit messages from any connecting line in the same manner in all respects and with the same rights and liabilities as in the case of messages received by the public company in the regular course of its business.

Provision is made for rents to be paid and the rates to be charged by the public company for the use of its lines by these private connecting lines, such rates to be fixed by the Government in unincorporated districts and by the municipal councils in incorporated districts at their pleasure.

It is further provided that every public company shall annually submit to the Government a schedule of its rents and rates and that these must have the approval of the Government before being put into effect. Provision is made for penalties in case of failure to comply with the law and for mandatory injunctions to enforce compliance.

The bill is brief and to the point. There is no excessive verbiage affording legal loopholes for evasions. It is, in fact, a measure meant to conserve the interests of the public in a public utility, and seems to deal with an important matter in a way that will work out satisfactorily to the people, while inflicting no injustice on the telephone company.

SEMI-CENTENNIAL OF STREET RAILROADING.

The month of March marked the fiftieth anniversary of the beginning of modern street railroading. On March 26, 1856, a horse railroad was opened for traffic between Bowdoin Square, Boston, and Harvard Square, Cambridge—not, indeed, absolutely the first of its kind, but the first to be continuously successful, making a start in the direction of its logical successor, the most complete and comprehensive rapid transit system in the world.

SCARCITY OF TELEPHONE POLES.

Man finds, says "Telephony," that if he would live well and comfortably he must be careful and thoughtful. Just now he is finding out in this country that he must extend his care and thought to the increase of the life of telegraph and telephone poles How important this problem is is indicated by the fact that there are 800,000 miles of telephone and telegraph lines in this country, requiring 32,000,000 poles. The present life of each pole is so short that they must be renewed approximately four times before trees suitable to take their places can be grown. A pole lasts in service about twelve years, on the average, but is made from a tree about sixty years old. In other words, to maintain a continuous supply five times as many trees must be growing in the forest as there are poles in use. The severity of this drain upon forest resources by the telephone and telegraph companies is obvious enough. Just as in the case of railroad ties, the question of pole supply has thrust itself into prominence. To lengthen the life of poles, and in this way to moderate the demand and conserve future supplies, has become an important matter, affecting the public as well as private interests.

Since 1902 the forest service has been making a thorough study of the preservative treatment of poles and of the value of the seasoning in relation to treatment. In this work its first object has been, as in its studies of cross-ties and construction timbers, to make the timber last as long as possible, so as to check the annual demand for renewal and thus lessen so far as possible the drain upon the forest. Co-operating with telephone and telegraph companies, railroads, lumber companies and individuals, it has urged forward a series of experiments covering all phases of the problem, from the question of the best season for cutting, through subsequent stages of handling, to the final setting of the pole. Some of the most important results obtained deal with the seasoning process.

Seasoning was studied in the first place to determine the rate at which poles become air dry, that is, lose as much moisture as they will part with through evaporation in the open air. The time of cutting was also carefully considered. Experiment proved that poles cut in the winter dry more regularly than those cut in other seasons, and also shows a greater loss in moisture at the end of six months' seasoning. The advantages of winter cutting are, therefore, even drying, with a minimum liability to check, and light weight—an obvious advantage for shipping by freight. Spring or summer cutting secures a more rapid loss of moisture at first, owing to the temperature, but only for three or four months. At the end of from six to eight months spring and summer cut poles are found to have dried only three-quarters as much as winter cut poles. Spring and summer cutting, however, would result in saving in freight and increased durability if the poles are to be shipped and used within three or four months after cutting.

The second point to be determined was the degree of shrinkage in circumference during air seasoning. This was found to be very light, averaging but little over 0.5 per cent at the butt and 0.6 per cent at the top. The rapid shrinkage of wood does not begin until the percentage of moisture is reduced lower than is possible in the case of telephone and telegraph poles in-or-out-of-door seasoning.

The effect of soaking in water upon the rate of seasoning was the third of the problems dealt with. The experiments substantiate the common opinion that poles soaked two to four weeks subsequently season at a materially increased rate.

Finally, it was found that checking in the course of seasoning is not serious when the poles have been carefully cut. Rapid-grown timber, however, when so carelessly cut as to leave jagged ends, was found to split badly at the butt and at the top.

Just how much thorough seasoning will add to the life of poles cannot be told until the actual tests are made in service. The poles upon which the tests are being made have been set in a line where their behavior can be compared with that of unseasoned poles, and will be closely watched. Upon a large number of the seasoned poles a test was also made to show the value of various preservative treatments, which is expected to throw additional light on the subject of durability.

CANADIAN EXPERIMENTS IN SMELTING BY ELECTRICITY.

J. Corbin Weld, Deputy Governor of the Canada Camp, who is now in London, says that he had just received information of an important experiment, which resulted in proving that smelting would be successfully achieved by electricity. The experiments were made, not by a body of men seeking to float a company, but at the expense of the Canadian Government, with a view of development of the iron ore industry in the Ontario district. He had received information that the results of the experiments were definite and conclusive and that the treatment of ore by electricity could be profitably carried out.

FINANCIAL REPORT ON THE A. I. O. E. E. BUILDING.

At the recent meeting of the American Institute of Electrical Engineers in New York, Mr. T. Commerford Martin, as chairman of the Building Fund Committee, announced that there has been subscribed a total amount of $132,389, or more than two-thirds of the sum needed for the land upon which the United Engineering building will stand. Of this amount $87,000 has been collected.

During the month the committee received from the American Telephone & Telegraph Company, the Western Electric Company, the New York Telephone Company and the New York and New Jersey Telephone Company a joint subscription of $25,000. and from Mr. Clarence H. Mackay, president of the Postal Telegraph & Cable Company, the generous personal subscription of $5,000, both of which have been collected. On the day of the meeting there was received from the Edison Electric Illuminating Company of Brooklyn a subscription of $1000.

Los Angeles, Cal.—L. C. Brand offers to build an electric railway between the town of North Glendale and Burbank, if the people will subscribe a bonus of $40,000 toward the project and furnish a free right of way.

San Francisco, Cal.—Work will be begun at once on the Haight street line by the United Railroads to relieve the pressure in the direction of Golden Gate Park and the beach. It is also proposed to extend the Fulton street line, which runs to Thirty-fourth avenue, to Forty-ninth street. This will give an added convenience to the travel toward the beach.

Sacramento, Cal.— Action on the application of the Central California Traction Company for a franchise for an electric road on the M street road was postponed until Saturday, July 14th by the Board of Supervisors. The postponement was made at the request of Attorney A. L. Shinn, who represents the company. The company thought it best to withhold the application for about two weeks, and to try to secure a private right of way.

San Francisco, Cal.—The California-street Railroad Company will have its line in running order within three weeks. Work on the power-house has been going steadily forward and it is thought that the machinery will be in running order in a few weeks. The power-house itself, at Hyde and California streets, was thoroughly wrecked and a gang of men is at work rebuilding the walls and repairing the engine room. The latter is already in shape, and as soon as the house is rebuilt the entire plant will be ready for service.

News Notes.

TRANSPORTATION.

San Francisco, Cal.—The United Railroads, finding itself exceedingly short of electric cars, is bending every energy to secure the early delivery of the fifty big cars that the Chicago City Railroad has generously turned over to President Calhoun.

Santa Cruz, Cal.—A deal has been closed between J. Martin, the electric light and power magnate, and J. W. Forgeus, representing the stockholders of the Union Traction Company, whereby the local street car system, including the Santa Cruz, Capitola and Watsonville Railway, passes into the hands of the Coast Counties Power Company, the new holding company for Martin & De Sabla's Santa Clara and Watsonville properties. Several extensions of the present system will be made and heavier rails will be laid on several portions.

Red Bluff, Cal.—The Town Trustees of this city have granted a franchise to the Northern Electric Company, giving them the right to use Main street for their interurban line now being constructed between Chico and this place.

San Francisco, Cal.—Sixty of the electric linemen have struck, owing to the failure of the United Railroads to give them an eight-hour day without reduction of wages. This would amount to an increase from 35 cents to 43¾ cents an hour, as they have been working ten hours a day and receiving $3.50.

San Francisco, Cal.—A meeting has been held at the offices of Miller & Lux, at 362 Howard street, and all property owners on that street were requested to attend. A committee has been appointed to confer with General Manager Chapman of the United Railroads in regard to the removal of the temporary tracks from Howard street used jointly by the Southern Pacific, Santa Fe, Ocean Shore and United Railroads for the removal of debris, and the speedy installation of the Howard street line. Mr. Chapman was personally in favor of the plan.

San Francisco, Cal.—Service has been resumed on the Guerrero street line to meet the needs of the people on Guerrero and Valencia streets.

Redding, Cal.—The Redding and Red Bluff Railway Company, which was constructing lines from Redding to Munroville, has been sold to C. E. Loss, who will go on with the construction of the road and eventually lay 250 miles of track in that section of the country. The name of the line will be the Shasta Southern.

Honolulu, H. I.—Acting Governor Atkinson signed the charter of the Kauai Railway Company, which is to build an electric railway from Kekaha mill to Wahaiwa. The incorporators are H. M. Von Golt, W. A. Kinney and others.

San Diego, Cal.—The National City and Otay Railroad has been formally transferred to J. D. Spreckels & Co. of San Francisco. Work will commence immediately on the construction of three new cars for the railroad. The work of electrizing the road which extends from San Diego to Tia Juana with a branch to the Sweetwater reservoir will be pushed to completion as rapidly as possible. For the present, the road will be electrized to Third street, Chula Vista, and later to Tia Juana.

Redding, Cal.—Superintendent Johnson of the Northern California Power Company, says that a new sub-station will be erected at once at the Mammoth mine. Last week work was begun on a new sub-station at the Balaklala mine. A new line will be built from the Balaklala sub-station to a new saw mill about one mile distant.

Reno, Nev.—State Engineer Tuttell has been to Ely, where he made arrangements for several large water appropriations, and says that before long there will be two large power plants and a cyanide plant erected in that town.

San Francisco, Cal.—Plans are rapidly being perfected for the big loop for turning the electric cars at the foot of Market street in front of the Ferry building. The congestion of traffic at that point has made the scheme appear advisable. The designs are being made and work will be begun at once.

Red Lodge, Mont.—The Montana Coal and Iron Company is considering the purchase of a complete electric power plant tobe erected on the Elijah Smith properties at Billings.

Idaho Falls, Idaho—Sealed proposals will be received at the office of the city clerk of Idaho Falls until July 30th, 1906, for the construction of a power plant on Snake river for the city of Idaho Falls, requiring the building of 2000 cubic yards of concrete masonry and the placing of 50 tons of steel reinforcement and structural steel, together with other necessary work.

Los Angeles, Cal.—Floods are delaying the completion of the Kern River plant of the Edison Electric Company. Work that might have been finished August 1st will not be in readiness before the middle of September.

San Luis Obispo, Cal.—The Supervisors have awarded a franchise to Russell Robinson to erect and maintain poles for electric wires along certain highways in the County of San Luis Obispo.

Aurora District, Nev.—An electric power plant will be erected on the Walker River to serve the mines of Aurora, Bodie and adjacent camps.

Marysville, Cal.— The Northern Electric Railway has applied for a franchise to extend the lines on Yuba, Fifth, Second, First, F, and Yuba streets, a total extension of two miles. The franchise will connect the line with the California Midland at Eighth and Yuba streets. It is rumored the line will be extended down the east side of the Feather River to tap several thousand acres soon to be colonized by Los Angeles capitalists. The laying of rails on the extension of the Northern Electric from Chico to Marysville will commence in ten days, grading being about completed.

Alameda, Cal.—Within a short time the Santa Clara avenue line of the Oakland Traction Consolidated will be running into Oakland, and the necessity of transferring to the narrow gauge Washington street cars will be eliminated. The company has a large force at work night and day laying tracks along Water street to Broadway from Webster street. Thecurve at Webster street has already been installed.

Riverside, Cal.—The San Bernardino Traction Company has ordered the rails and ties for the new line which is to connect Riverside, Colton, San Bernardino and Redlands. Application for the local franchise will be made in the immediate future.

Watsonville, Cal.—Chas. F. Sanborn, local manager of the Watsonville Transportation Company, has received instructions to employ a gang of men to commence work reballasting the roadbed of the electric line that connects this city with Port Watsonville. C. O. Briggs has been awarded the contract and has begun the work of repainting all of the company's cars.

San Diego, Cal.—As a result of a meeting of the Chamber of Commerce of San Diego and of Escondido, Cal., H. K. Cravath has been hired to solicit subscriptions to the amount of $150,000 for stock in a proposed road from Escondido to San Diego. As soon as this amount is raised, grading on the line will begin.

INCORPORATIONS.

San Francisco, Cal.—The Saratoga Gravel and Water Company has been incorporated with a capital stock of $500,000 by C. C. Bell, E. W. Knapp, F. A. Alexander, H. W. Snow, E. J. Talbot.

San Francisco, Cal.—The Dendell Electrical and Manufacturing Company has been incorporated with a capital stock of $25,000 by A. E. Dendell, E. M. Schlessinger and Elizabeth Dendell.

Los Angeles, Cal.—The Southern California Gas Circuit Company has been incorporated with a capital stock of $150,000. The enterprise is headed by James W. Hellman of Los Angeles, Norman Cohn and Samuel T. Mock.

San Luis Obispo, Cal.—Articles of incorporation of the La Grande Oil Company have been filed by T. B. Adam, E. T. Bryant, H. L. Smith and F. D. Hall of Santa Maria and F. J. Burnett of Arroyo Grande.

Sonoma, Cal.—The Weaver Patent Power and Pump Co. has been incorporated at this place by W. O. Hocker and M. J. Hibbard and others.

San Francisco, Cal.—The Guarantee Electric Works has been incorporated with a capital stock of $15,000 by Chas. Pfluger, J. K. Clarke, Laura Pfluger, J. W. W. Clarke and Amy Clarke.

San Francisco, Cal.—The California Midland Railway Company has been incorporated with a capital stock of $3,000,000. The directors of the company are John Martin, E. J. de Sabla, L. H. Susman, L. W. Pryor and W. J. McLean.

San Francisco, Cal.—The Coast Counties Light and Power Company has been incorporated at this place with a capital stock of $1,500,000, by L. H. Susman, H. Malloch, L. W. O. Pryor, W. J. McLean, H. Bostwick, W. B. Bosley and R. A. Morton.

Helena, Mont.—Articles of incorporation have been filed for the Chateau Milling and Power Company of Teton county, to do business at Chateau. The capital stock of the company is $15,000 and the incorporators are: J. W. Jameson, Guy S. Jameson and Philip H. Cole, all of Chateau.

OIL.

Bakersfield, Cal.—A lease has been filed of the Maricopa Oil Company's property, on the north half of the west half of the west half of the southwest quarter of section 1-11-24, to the Maricopa Road, Oil and Development Company. Attached to the document is an assignment of the property to C. B. Barnes of Los Angeles. The lease is for a term of fifteen years and the purpose of the company is to develop the oil land.

Reno, Nev.—Ten thousand inches of water, practically the entire flow of Carson River, has been taken up for power purposes by John Humphrey, representing the Goodyear Rubber Company. As soon as the company perfects the title a 500-h. p. generating station will be erected.

Watsonville, Cal.—President F. Smith of the Watsonville Water Company has been in Watsonville, accompanied by his engineer, Wynn Meredith, in connection with certain improvements that are to be made at once to the company's water system in this valley. Plans and specifications have already been prepared for the installation of a 4,500,000 gallon settling and storage reservoir on the company's property on the Santa Cruz road, near this city. Engineer Meredith will arrange the final details for a modern self-cleaning screening system.

Oakland, Cal.—The erection of the new water and oil pumping plant at the Southern Pacific Company's Oakland mole has been commenced. A large crane has been put in place and the steel beams that are to support the two 65,000-gallon tanks were hoisted into position. A complete system for pumping fresh water for the boilers of locomotives and ferry boats, and for salt water for flushing and fire purposes, is to be installed in connection with an air compressor.

Corona, Cal.—The Woods Realty Company is to put down four new wells during the summerr and erect pumping houses.

City of Mexico, Mex.—Wm. Sterns has applied to the Federal Government for a concession to utilize a waterfall of 15,000 h. p. on the Rio Blanco in Nuevo Leon. The power will be used to generate electricity.

San Francisco, Cal.—At a meeting of the Mission Improvement Association held at Rolfe's Hall a few days ago, the association decided to petition the Fire Commissioners and the Board of Supervisors to have five cisterns in the Mission that were filled up with earth prior to April 18th, cleaned and filled with water. This action was taken in order that, in case of fire, protection independent of the Spring Valley Water Company may be afforded property owners.

San Francisco, Cal.—Mayor Schmitz and the Board of Supervisors are to be asked to arrange a bond election to be called at an early date, to provide for the establishment of the proposed Twin Peaks salt water system.

San Francisco, Cal.—It is the intention of the Olympic Salt Water Company to locate a pumping station on the bay shore near North Beach, and one in the district south of Market street, to dispose of water to the municipality as the Spring Valley does. It intends to lay mains throughout the city, in order that adequate fire protection may be insured. Later it expects to dispose of the entire plant to the city.

Susanville, Cal.—A contract has been closed by the Lassen Willow Creek Water Company to drive a big tunnel to tap Eagle Lake for the purpose of securing water for the irrigation of Honey Lake Valley.

El Paso, Tex.—Messrs. G. & O. Braniff & Co. have applied for a concession to utilize 13,000 liters of water per second at confluence of the Blanco waterfall in generating electricity.

Lewiston, Ida.—Water Superintendent W. A. Smith, in his letter and report to the Council, recommended that the city make preparations for the establishment of a $10,000 pumping plant, in case of the disabling of the plant now in use. He also recommended that the city make some move toward curtailing the flow of the waters of Lindsey Creek into the intake pipes at the station.

San Francisco, Cal.—Announcement has been made that the California Petroleum Refineries, Ltd., a corporation composed of London and California capital, signed a contract with the Japanese Government for the delivery of two million barrels of oil each year for a period of ten years. The total amount of oil to be supplied will be 20,000,000 barrels. It is to be used in transports and some of the warships of the Japanese Government.

Los Angeles, Cal.—The Union Oil Company has announced that the company has signed a contract with private parties in Chile for 10,000,000 barrels of oil, to be delivered within a period of ten years at the port of Iquique, in the State of Turapaca. The oil will be used as fuel.

The Union Steamship Comany, a subsidiary of the Union Oil Company, reports the arrival of the steamer Lansing, the largest oil carrier in the Pacific Ocean. Her capacity is 46,000 barrels of oil, or nearly twice as much as that of any other tank steamer now in the trade.

ELECTRIC LOCOMOTIVES FOR THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.

The present plans of the New York, New Haven and Hartford Railroad Company contemplate the electrical operation of their main line between New York City and Stamford, Conn., a distance of over thirty-three miles. That portion of the road which lies between the Grand Central Depot and Woodlawn, N. Y., utilizes the tracks of the New York Central Railroad and constitutes a portion of the electrical zone of that company within which the direct-current third-rail system is being installed. Between Woodlawn and Stamford the road will be equipped with the Westinghouse single-phase, alternating current system, and the trains will be operated by electric locomotives which take alternating current from the overhead trolley line. The power station of the New Haven Company will be located at Riverside, Conn., three miles from Stamford. The power equipment will include three Westinghouse-Parsons horizontal steam turbines driving twenty-five cycle, alternating current generators of the revolving field type, which have a rated continuous capacity of 3,750 kilowatts, each when running single phase and of 5,500 kilowatts when supplying a three-phase service. The generator armatures are designed for both single-phase and three-phase connection. They are wound for 11,000 volts, and are connected direct to the trolley system. Absolutely no transforming stations or reducing transformers along the line will be required, but the entire system will be operated direct from a single central station without the interposition of sub-stations or auxiliary apparatus of any kind between the switchboard and the cars. This desirable simplicity is made possible by the alternating current system and the high trolley e. m. f. which will be employed. It is probable that, with a service equivalent to that now given by steam locomotives, electrical operation can be extended a distance of twenty miles beyond Stamford without the use of a higher transmission potential or the introduction of transforming stations.

The overhead construction will be supported from steel bridges which will be located every 300 feet and which will normally span from four to six tracks, though on certain portions of the road longer bridges will be employed. Every two miles the bridges will be made of a specially heavy construction, forming an anchor-bridge to make the overhead structure even more secure. The trolley wires will be hung from steel messenger cables which, in turn, will be supported by heavy insulators mounted upon the steel bridges. Each trolley wire will be suspended from a pair of steel messenger cables by triangular supports, forming a double catenary suspension of great strength and stiffness. The triangular supports are placed about ten feet apart. The messenger cables will have a total sag of about six feet, while the trolley wire itself will be held in a practically horizontal position.

The trolley system will be divided into sections approximately two miles in length, each section being separated from its neighbors by heavy line insulators. Adjoining sections will be connected through automatic oil-type circuit breakers. If a short circuit or other trouble occur in any section, therefore, it can be cut out without disturbing the operation of other portions of the line. Two feeder wires will be carried the whole length of the alternating current line and will be so connected to the various sections of the trolley system by automatic switches that any section of four or more trolleys can be cut out of service and those beyond kept in operation.

The trolley wires will be held normally at a height of twenty-two feet above the track. The overhead system is designed with a safe margin to meet the stresses imposed by the most severe conditions, such as high winds or heavy coatings of ice.

Thirty-five locomotives are to be furnished by the Westinghouse Company, suitable for operation on the direct current division between the Grand Central Depot and Woodlawn, and on the alternating current portion of the line between Woodlawn and Stamford. One locomotive has already been constructed and the results obtained assure the complete success of the alternating current system.

The frame, trucks and cab of the locomotive were built by the Baldwin Locomotive Company, according to designs developed with the co-operation of the New Haven Railroad and the Westinghouse Electric and Manufacturing companies.

The frame is of the rigid type, with side pieces made of steel channels to which are bolted and riveted other steel channels placed transversely, two over each truck, forming transoms for the transmission of the weight to the center pins. These channels are placed outside the wheels and as close together and as low down as the wheels and the drawhead will permit, and are braced and squared by substantial steel flooring plates which are riveted and bolted to the top flanges. The transoms are further braced by gusset plates which are riveted and bolted to the bottom flanges of both sets of channels and which transmit the tractive power from the center-pin to the side channels. The frame is still further strengthened and secured by diagonal plate braces.

As the entire space between the wheels is occupied by the motors, it was impossible to transmit the draw-bar pull through the center line of the locomotive; so the entire strain is carried by the strong plate girders which make up the locomotive frame. A Westinghouse friction draft gear is mounted directly underneath the box girder at each end and is applied to two steel bumpers laid horizontally between vertical gusset plates on the ends of the side channels.

The running gear consists of two trucks, each mounted on four sixty-two-inch driving wheels. The trucks have side frames of forged steel to which are bolted and riveted pressed steel bolsters which carry the center plates. The weight on the journal boxes is carried by small semi-elliptic springs with auxiliary coiled springs under the ends of the equalizer bars to assist in restoring equilibrium. A very strong construction is secured without excessive weight by the use of bolsters thirty inches wide at the center plate and extended to nearly double that width at the ends which are bolted to the side frames. Center pins eighteen inches in diameter transmit the tractive effort to the frame. They are well lubricated to permit free motion on curves. The truck pedestals are provided with wedge and gib adjustments to take up wear, and the bearing brasses are easily removable by hand. The distance between truck centers is fourteen feet six inches.

Th cab is formed of sheet steel mounted on a framework of Z bars which supports the walls and roof. Windows are provided at each end, giving an outlook on both sides and in front of the locomotive; and the driver is so close to the front that he can see the track a very few feet ahead. This advantage is not possessed by any type of steam locomotive now in service. The master controllers, auto-transformers, instruments, grit resistances, air operating valves, compressors and other auxiliary apparatus are mounted inside the cab upon an angle-iron framework which is built into the cab and securely anchored to floor and roof. A clear passage-way is left through the center. Trap doors in the floor furnish easy access to the motors for inspection or repair. The equipment of the locomotive includes four gearless motors, controlling apparatus and auxiliaries.

The motors are of the compensating gearless type, designed for operation on both single-phase alternating and direct current. They are wound for approximately 235 volts on alternating current and 275-300 volts when operated by direct current. They have normal rated outputs of 250 horsepower on the basis of ordinary railway practice, and a continuous capacity of 200 horsepower each. The locomotive, therefore, has a continuous operating capacity of 800 horsepower.

The motor frames are made of cast steel and are of circular, skeleton form. They are divided horizontally into two parts in order to give access to the inside of the field or to the armature. A laminated core with slotted projecting poles is built up within this frame and wound with field coils of flat copper strap insulated between turns with asbestos and filled with an insulating compound which is heat-conducting and waterproof, so that a sealed coil is produced which can withstand moisture and internal heat. Copper bars are placed in slots in the pole faces and connected to form a continuous neutralizing winding, which forms part of the circuit, including the main field coils, the armature coils and the auxiliary winding, all in series. This auxiliary winding produces a magnetic field which opposes and neutralizes the reaction of the armature. It is so formed that it need not be disturbed in order to remove the main field coils.

The armature core is built up of soft steel punchings, which are assembled on a cast iron spider and held in place and keyed to prevent their turning. The surface is slotted and the armature winding is arranged in three layers. The two upper layers are composed of copper strap connected to form the usual direct-current type of winding. The third layer constitutes the preventive winding. It is connected between the commutator and the main winding. This preventive winding is so proportioned as to minimize the combined loss due to the normal working current and that which is produced in the coil under commutation when short-circuited by the brush in an alternating field. The individual coils are insulated along their entire length by overlapping layers of mica tape and each group is further insulated from the core by a moulded mica cell. The completed winding is held firmly in position by insulating wedges. The ends are banded down against the coil supports.

The commutator is formed of copper bars clamped between V-shaped cast steel rings and insulated by V rings and bushings of moulded mica. It is pressed on the spider, which supports the armature core. The brush holders are of the sliding type with arms mounted on a rocker ring. Tension is provided with flat phosphor bronze springs, which have sufficient turns and are so mounted that friction between turns is eliminated and uniform pressure secured over a considerable range without adjustment. Each spring is held in a harness which definitely fixes the radius of movement of the spring tip. A pawl on the side of the spring harness allows easy adjustment of the tension.

The weight of each motor is carried on a frame which passes over the wheels and side frames and rests on the journal boxes. Each frame carries four bolts, which receive the weight of the motor, and each bolt is fitted with a heavy coil spring at its lower end, through which all weight is transmitted to it, so that the motor is carried on very flexible springs and is independent of the truck frame. The torque of the motor and the jar caused by sudden starts and stops are transmitted from the motor to the truck through heavy tie-roads, which affect the motion of the motor only lengthwise of the locomotive. The armature is not placed directly on a shaft, but is built up on a quill, through which the car axle passes with about five-eighths of an inch clearness all around. The bearings which carry the field frame are mounted on this quill and from a flange at each end of the quill seven round pins project parallel to the shaft into corresponding pockets formed in the hub of the driving wheel. The torque of the motor is transmitted from these pins to the wheel through helical steel springs which are wound with their turns progressively eccentric and which are contained between two steel bushings, the smaller of which slips over the pin and the larger fits in the pocket in the wheel. These springs are under compression both longitudinally and horizontally, so that, at all times, they fill the pockets in the wheel, but permit a vertical and a lateral motion. Their longitudinal compression between the quill and the segmental cover over the outer ends of the pockets in the wheel keeps the motor at all times midway between the hubs. The end play of the motor does not come directly on the wheels, but is taken by strong coiled springs inside of the driving pins, which press against the covers in the outer ends of the spring pockets in the wheels. Though normally required to transmit only the torque of the motor and to keep the motor axis parallel to the axle, these springs are amply strong to carry the entire weight of the motor. They allow a total vertical movement of about three-quarters of an inch. The torque of the motor is taken by heavy parallel rods, which anchor the frame to the truck above and below the axle and permit vertical or side motion of the motor, but prevent excessive bumping strains from coming on the driving springs. If these springs are compressed more than one-quarter of an inch by the heavy centrifugal force exerted by the motor when rounding curves, the force is taken up by noses on the motor which fit into corresponding recesses in the cross ties between the side frames of the locomotive.

This suspension has the advantage of removing all dead weight from the axle, of driving through springs, and at the same time of having the motor thoroughly anchored to prevent undue strain on the driving spring. The only parts of the locomotive not spring supported are the driving wheels, axles and journal boxes. It is a great improvement on any method of mounting gearless motors heretofore devised.

On the direct-current part of the line current is taken from the third-rail system by eight collecting shoes. four on each side of the locomotive, arranged in pairs of two each. There are two pairs on each side, one at each end, for the purpose of bridging such gaps as may occur in the third-rail system. The direct-current contact shoes are designed to work on two forms of third-rail—one in which the shoe runs under the rail and the other on top of the rail. To collect alternating current from the high-potential overhead trolley line, the locomotive is equipped with two pantagraph-type bow trolleys, each of which has a capacity sufficient to carry the total current required by the locomotive under average conditions, two being provided to insure reserve capacity.

On direct current the motors are controlled in series parallel, as in ordinary railway practice. In alternating-current operation no resistance is used in the regular run, but a small resistance, which constitutes a preventive device to diminish the short-circuiting effect when changing from one transformer tap to another is employed in passing from one working step to the next. There are six alternating-current voltages or running points, corresponding to six taps from the auto-transformers, and there are a small number of midway steps which are used only in passing between working notches. Experience has shown that the number of steps required in alternating-current operation to give a smooth acceleration is considerably lower than in direct-current practice. In consequence the controller is so arranged that on alternating current about half as many steps are used as on direct current. Tests so far conducted show that the acceleration on both alternating and direct current is very smooth.

There is one feature of the direct-current control which is not generally found at the present time in direct-current equipments, viz., the shunting of the field for higher speeds. In the series position in direct-current operation the motors have an efficient running point. It is usual railway practice to pass from the series to the multiple position without an efficient intermediate running speed. With the New Haven equipments, however, the type of motor used permits an almost indefinite shunting of the field, without impairment of commutation or operation and higher speeds are provided by shunting the fields before passing into multiple. In this way several efficient running points are obtained between the series and multiple positions; and tests have shown that these motors operate properly on direct current with their fields shunted down to less than half their normal strength. When operated on direct current, the current is fed directly to the motors. On alternating current, however, auto-trans-

formers are required, as the alternating current trolley voltage is 11,000. Two such transformers form part of each equipment, one mounted on each side of the cab floor to balance the weight. They are connected in parallel across the high voltage, but on the low-voltage side each transformer feeds one pair of motors through a separate control unit. This means that the control system when operated on alternating current consists of two normally independent units.

There are six switch groups, each containing unit switches. The two line switches are so connected in the switch groups that each carries the current supply to each pair of motors when they are operating in parallel combination. When the motors are in series, one of the line switches carries the current supply to all. Each line switch is provided with an overhead trip, so connected that all of the switches of both switch groups, as well as both the line switches, open in case of an overload or short circuit on either pair of motors or in the circuit of either pair. The overload trip is automatically locked out when brought into action and cannot be reset until the master controller is returned to the off position.

The external resistances used in regulating the flow of current to the motors are arranged in two groups, which are connected in series when the motors are in series, and in series with each motor when the motors are in parallel. The change over between the direct current third rail and the alternating current overhead system can be made easily and quickly, even when the locomotive is running at full speed.

An ammeter is mounted in each end of the locomotive in plain view of the operator when at the master controller.

The master controller is of the drum type and is operated by a lever, which moves through an arc of about 60 degrees, with notches and latch wheel to define the different positions. Reversing is accomplished by a separate handle, which interlocks with the main lever. When the master controller is in the off position, connections are so established that all circuit breaker trips which may be open are closed by the simple closing of a small switch conveniently located in the locomotive cab. Current is supplied to the control circuits by two sets of seven-cell storage batteries, each of which has a capacity of forty ampere-hours and weighs 150 pounds.

In connection with the switch groups, cut-out switches are provided, so that either pair of motors may be cut out by simply rendering certain switches inoperative. It is thus possible to cut out the motors without manipulating the main circuit.

The auxiliary equipment includes two air compressors driven by motors which can be operated on either alternating or direct current; two blowers driven by similar motors and which furnish air to the transformers, motors and direct-current rheostats; oil circuit breakers for the high-tension circuits; switches to change the equipment from alternating to direct current; a steam generator to supply heat to the railway coaches in cold weather; a complete Westinghouse air brake equipment, signal apparatus, automatic bell ringers, whistles, sanding apparatus, etc.

The New Haven locomotive measures thirty-six feet four inches over the bumpers and weighs approximately eighty-five tons. It is capable of handling a 200-ton train in local service on a schedule speed of twenty-six miles per hour, with stops averaging about two miles apart, making in such service a maximum speed of about forty-five miles per hour. It can also handle a 250-ton train on through servce with a maximum speed of about sixty miles per hour. With heavier trains it is planned to couple two or more locomotives together and operate them in multiple.

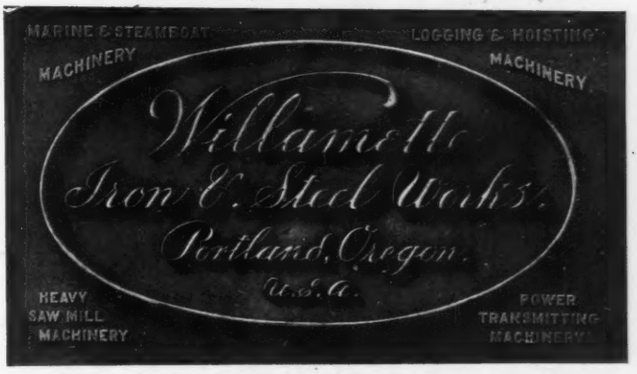
San Francisco, Cal.—The Pacific Gas and Electric Company is to put up a $250,000 building to house its general offices.

GUAM-JAPAN CABLE.

On June 26 cordial greetings were exchanged between President Roosevelt and Mutsuhito, the Emperor of Japan, over the American cable connecting the Island of Guam and Japan, which was recently completed. The President's message, expressing the good-will of the American people and himself, was sent the day before and the Emperor's reply reached Washington on Tuesday. The line is part of the Commercial Cable network in the Pacific.

ETHICS OF ENGINEERING COMMISSIONS.

In connection with Dr. S. S. Wheeler's fine presidential address before the American Institute of Electrical Engineers on the professional ethics of engineers, the following passage may be quoted from an address by Dr. Rossiter W. Raymond to the graduating class of Lehigh University: "Perhaps the commonest question of casuistry occurring in modern business is that of commissions. As the agent of your employers you have to purchase a steam engine. After getting the prices and inspecting the engines of all the manufacturers you decide upon the machine most suitable, on the whole, for your purpose, and in all legitimate ways beat down the sellers thereof to their lowest price. Just as you are about to close the bargain at the price they say: 'This covers, of course, your commission of 10 per cent.' When you reply that you do not expect any commission and suggest that, instead of paying it to you, they take it from the amount of the bill they send to your employers they tell you that according to some trade agreement they cannot charge a lower price, but can pay a commission to the selling agent. Now, you are not the selling agent, but the purchasing agent, and, explaining this difference to them, you tell them that you will be in honor obliged to pay your employers whatever commission may be paid you. To this they reply, with a kindly but cynical smile, that they do not care what you do with the money after you have got it, and you see clearly that they regard your protestations of honor as part of the formula which precedes your acceptance of the money. They do not really believe that you will not keep it if you get it. I am repeating an episode of my own experience and perhaps my solution may be of use to you. I declined the commission offered in currency; required it to be put in the form of a check to my order; indorsed that check to the order of my employers and presented it to them, leaving them, if they saw fit, to return it to me as a legitimate perquisite of my position. They did not see fit, and they were quite right. But the most important feature in my action was that the return of the check, thus indorsed by me in their favor, convinced the manufacturers of my honesty as no amount of high toned oratory on my part could have done."



Hoisting and Constructors' Machinery a Specialty

AN INCIDENT IN BRITISH MUNICIPAL OWNERSHIP.

The Newcastle-on-Tyne Electric Supply Company was organized several years ago for the distribution of power in the vicinity of Newcastle-on-Tyne. The company was debarred from supplying current to Newcastle owing to the existence there of a municipal plant, but it has had a remarkably successful career, notwithstanding this handicap. On the other hand, the municipal Tynemouth station has been uniformly unsuccessful from a financial standpoint, and recently the authorities were faced with the necessity of adding additional plant, which, while adding to the investment, would carry with it no corresponding increase in revenue. As a result of this situation, the municipality has just made a contract with the supply company for one and a quarter million kilowatt-hours annually of electrical energy at a price less than one-half what it costs the municipal plant to generate its present output The supply company is also given the right to supply large power consumers within the area of the corporation municipal supply district from sub-stations, the municipality to collect the accounts and retain 5 per cent commission.

"Third Rail Eye" is the Boston name for a "complaint" known in New York ever since the elevated roads went into operation. The Boston Elevated Railway Company, by reason of a decision of the Supreme Court rendered this week, may find itself open to local suits arising out of injuries which have been known as "the third rail eye." It has been asserted that many persons have suffered injury to their sight in consequence of particles of metal falling from the elevated structure. In the case before the court the plaintiff got a verdict of $2000, which the court reduced to $1000. The defendant filed exceptions, which were overruled by the Supreme Court.

TELEPHONE CONVENTION.

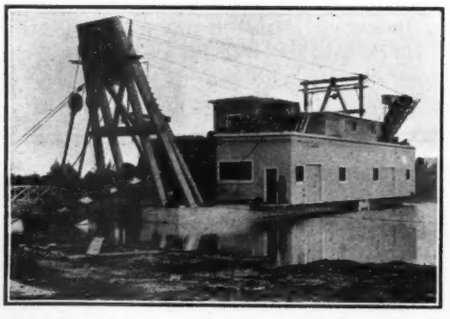
The National Interstate Telephone Convention began at the Auditorium Hotel, Chicago, on June 26. President J. B. Hoge of Cleveland said in his address that competition was the only way to reduce telephone rates. "The public never can get reduced rates for telephone service in Chicago or any other city," continued Mr. Hoge, "until there is a competing company. Eleven years ago there were but 300,000 telephones in the United States. To-day there are 5,000,000, and the increase has been brought about by the independent telephone companies, who have 3,000,000 telephones. There are 7000 operating independent companies and 12,000 exchanges."

HANDS ACROSS TO JAPAN.

Step by step since 1902 the work has gone on of laying the Commercial Cable network in the Pacific Ocean and it is with great pleasure that we note this week what may be regarded as the natural completion of the enterprise in bringing Japan into the system. President Roosevelt and Emperor Mutsuhito have exchanged felicitations in cordial and appropriate language that expresses their sense of the importance of this link, putting the Tokio office of the company in direct communication with Guam, and thence with the other lines. Japan and the United States have recently become great Pacific powers at the same moment; their relations are intimate and friendly, and this American cable has its role to play in the promotion of intercourse between the New World and New Asia.

Helena, Mont.—Articles of incorporation have been filed for the Choteau Milling and Power Co., of Teton County, to do business at Choteau. The capital stock is $15,000; incorporators: J. W. Jameson, Guy S. Jameson and Philip H. Cole.

Gold Dredges



The Latest Risdon 7-ft Dredge—Baggett No. 1, at Oroville, Cal.

We are ***The Largest and Most Successful*** Builders of ***Gold Dredging Machinery*** in the World. Send us detail of your requirements. Estimates will be then forwarded.

Send for Gold Dredge Machinery Catalog No. 17. New Edition nearly ready.

RISDON IRON WORKS

311 Steuart Street San Francisco, Cal., U. S. A.

TELEPHONES AND TELEGRAPH.

San Francisco, Cal.—Dr. F. Butterfield of Oakland, who represents the Independent Telephone Company, has filed a bid of $27,000 for a telephone franchise in this city. Attorneys Asher and Brobeck, representing the Independent Telephone Company, claim that the franchise awarded to the Home Telephone Company on April 23d was not legally awarded as a non-judicial day existed at that time and was extended by the Legislature, in so far as the statute of limitations applied to certain classes of proceedings, of which this is claimed to be one, until July 10th. The Independent Company holds that under the law and the conditions developed after the big fire, they had until July 10th in which to bid for the franchise, the limit of the time not expiring until then.

Berkeley, Cal.—The Home Telephone Company, through W. T. Thomas, its president, has filed a formal application for a 50-year franchise with the Town Trustees.

Oakland, Cal.—The Sunset Telephone Company is erecting a two-story brick and steel frame building at the corner of East 12th avenue and 17th street, to be used as offices for the company.

Alameda, Cal.—The application of the Home Telephone Company of Alameda County for a franchise to construct and operate an automatic system in this city has been laid aside indefinitely. The City Trustees feel that they wish to secure the opinion of the residents before passing on any application.

San Francisco, Cal.—At a meeting of the Mission Promotion Association, held at Rolph's Hall, a resolution was passed calling on the Telephone Company to improve the service in the Mission district.

San Francisco, Cal.—A prominent telephone official says that the Pacific States Telephone and Telegraph Company is sparing no expense to rehabilitate its San Francisco system, which received a very severe blow from the great fire. He says that 15,000 of the original 52,000 subscribers are receiving service now and additional telephones are being installed at the rate of almost 200 a day. Permanent switchboards will be installed in the four class A office buildings that were burned out but not destroyed. This will be done as soon as the necessary equipment arrives from the East. Much of the switchboard material is on the road, 127 carloads of telephone supplies having been shipped already. The offices that were destroyed will be rebuilt, including three new offices in the unburned district. There has been a remarkable demand for renewed telephone service. It is probable that much of the dissatisfaction with the service was caused by the lack of a telephone directory since the fire. This will be obviated by the issuing of the new and complete book which is just ready for distribution. The new main office on Bush street is now serving nearly two thousand subscribers with a temporary switchboard. Large multiple boards will be installed in this building and in the South office as soon as repairs are completed, and the equipment is on hand. A new cable, which is expected to arrive soon, will be laid across the Bay, and the defects in the Oakland service will be eliminated.

LIGHTING.

Tonopah, Nev.—John Martin and L. P. Lowe of the California Gas Company of San Francisco will shortly install a gas plant at Tonopah. The gas mains are being laid.

Los Angeles, Cal.—The Southern California Circuit Gas Company will begin operations in Glendale and surrounding towns where it can get permission to lay its pipes.

Salt Lake City, Utah—At a meeting of the citizens of this city a motion was carried that the Council take steps for a temporary lighting of streets pending the erection of a municipal plant.

THE ELECTRIC STORAGE BATTERY CO.

Philadelphia

"Chloride Accumulators" for Railway and Lighting Plants

"Exide" Batteries at Golden Gate Avenue and Gough Street

525 Thirteenth Street - - - OAKLAND, CAL.

The Seattle Electric Company

907 FIRST AVE., SEATTLE, WASH.

Can make Quick Deliveries of

Electric GENERATORS AND MOTORS. SUPPLIES OF ALL KINDS.

Electric CHANDELIERS. SIGNS.

Electric HEATING DEVICES.

NORTHERN PACIFIC YELLOWSTONE PARK LINE

If You Travel

Secure Your Tickets *via* PORTLAND and

Northern Pacific Railway

YELLOWSTONE PARK LINE

Park Now Open for Season of 1906

Write or call for Rates and Literature

T. K. STATELER, Gen. Agt. 1114 Broadway, Oakland.

C. E. JOHNSON 125 West 3d St., Los Angeles

GEO. E. CARTER CO.

ROUND RED CEDAR SAWN REDWOOD **POLES**

Temporary Office:

3637 CLAY STREET, SAN FRANCISCO.

THE LATEST AND BEST IN

SIGHT-FEED LUBRICATORS FOR STEAM ENGINE CYLINDERS

THE POWELL "TROJAN"

(IMPROVED "CLASS A")

By long odds the most artistically proportioned, convenient to manipulate, and the highest possible workmanship. Like all styles of Powell Lubricators, the Sight Chamber and Oil Index Glasses are to the right and left of the Oil Chamber, while the connecting discharge arm is at the rear of same. This arrangement will be found very convenient when adjusting the valves or replacing broken sight glasses. It also renders the parts easily accessible and obviates the constant danger of burning the hands, as with the old forms. The Ejector Valve, as with all of Powell's Improved Lubricators, enables the engineer to start or stop the operation of the Oil Feed at any time, without disturbing the adjustment of the Regulating Valve when once set.

The filling is done directly into the Oil Chamber through Filling Plug, enabling rapid filling.

There are no joints about this cup. The arms and body are cast in ONE PIECE—a construction peculiar only with Powell's Lubricator.

[Supplied by Jobbing Supply Houses in all Principal Cities

Manufactured by THE WM. POWELL CO.

EVERYTHING IN THE LUBRICATING LINE.

For Sale by BAKER & HAMILTON, 115 Berry Street, San Francisco

Ask for Descriptive Circulars of our Re-constructed Star Valves

FINANCIAL.

San Francisco, Cal.—An assessment of $10 per share has been levied upon the capital stock of the North Shore Railway Company, payable immediately to F. B. Latham, the secretary of the corporation, at its office in the Ferry Building. Any stock upon which this assessment shall remain unpaid on July 31, 1906, will be delinquent and advertised for sale at public auction, and unless payment is made before, will be sold on August 25, 1906.

Sacramento, Cal.—The chief feature of interest at the meeting of the City Trustees a few days ago was the effort of the Northern Electric Company to get the ordinance passed allowing it to come into the city by a subway at the north levee and enter upon lands it has acquired in the vicinity of B, C and D and 16th, 17th, 18th and 19th streets. The board was favorable, but will not vote until two weeks hence.

Oakland, Cal.—F. C. Havens of the Realty Syndicate, who went East a few weeks ago to arrange for the financing of the Contra Costa Water Company's sale to the Syndicate Water Company returned July 7. It is given out that a cash payment of $20 a share will be made on the 57,000 shares outstanding, and that the remainder of the purchase price will be taken in bonds.

Pasadena, Cal.—Plans for the city to erect a municipal lighting plant have received a setback, as it is announced that no bids have been received for the bonds from which the money was to have been raised. The time for bids has expired.

San Francisco, Cal.—The Central Investment and Water Company has removed its principal place of business from San Francisco to Los Angeles, Cal.

Marysville, Cal.—The Marysville and Nevada Power and Water Company will hold its annual meeting on July 18th in this city. J. E. Ebert is secretary of the company.

San Francisco, Cal.—A special meeting of the stockholders of the Western Electric Company has been called for September 1st at 642 Folsom street, to vote upon increasing the capital stock from $25,000 to $100,000, shares to be par value $100 each. J. L. Muller is secretary of the company.

Stockton, Cal.—The City Council has ordered a special election for July 31st, at which will be submitted the question of issuing bonds to amount of $764,000 for the following improvements: A steam power electric lighting plant, $160,000; rainfall sewer, $30,000; water way improvements, $15,000, and other improvements.

Berkeley, Cal.—At the meeting of the Finance Committee of the Board of Regents of the University of California, which was held July 10th, President Wheeler transferred to it $100,000, which had been placed in his hands by Clarence H. Mackay for the foundation of a John W. Mackay Jr. professorship of electrical engineering in memory of his brother. Clarence H. Mackay and Mrs. John W. Mackay share equally in the gift. Professor C. L. Cory, the head of the department of mechanical and electrical engineering, is to be the first to fill the chair. This bequest is a sequel to the offer of $100,000 telegraphed to President Wheeler by Mr. Mackay a few days after the earthquake.

Los Angeles, Cal.—The City Council has instructed the City Attorney to take immediate steps to compel the Lowe Gas Company to pay its license tax to the city. The tax now amounts to $2300.

Oakland, Cal.—The first payment of half a million dollars has been made for the stock of the Contra Costa Water Company by the members of the Realty Syndicate. In addition to the half million already paid, $1,000,000 will also be paid on the purchase to the stockholders of the old company.

Hallidie Machinery Co.

315-317 Second Avenue, So. *SEATTLE*

Can make **QUICK SHIPMENTS** from stock of Machine Tools, Steam Plant Equipment, Gas Engines, Air Compressors, Rock Drills, Pneumatic Machinery, Wood Working Machinery, etc.

We have the Largest Stock of Machine Tools on the Coast.

Fort Wayne Electric Works

Mfrs. "Wood" Systems FORT WAYNE INDIANA

INDUCTION WATTMETERS

For Single and Multiphase Circuits of all Voltages and Frequencies

Office now permanently located at

403-405 Atlas Building, San Francisco 449

C. A. Burkhardt, Pres. C. A. Merriam, Treas.

Western Mantle Co.

Manufacturers of

Incandescent Gas Mantles

Large Stock on Hand for Quick Delivery.

Office and Factory.

28 FRONT STREET **PORTLAND, ORE.**

Do not Forget Us When in Need

We make a Specialty of

Materials for Pole Line Construction

Foundry, Machine and Wood Shop Work of all Descriptions. Prompt Delivery.

BENICIA IRON WORKS ***Benicia, Cal.***

Temporary Office, 516 11th St., OAKLAND

Phone Oakland 7584.

U. S. Cast Iron Pipe & Foundry Co.

Manufacturers of

Cast Iron Pipe

In all regular sizes, 3 in. to 84 in.

For WATER, GAS, SEWAGE, DRAINS, CULVERTS, etc., Flanged Pipe, Flexible Joint Pipe, Special Castings, Large Cylinders, Heavy Castings.

General Offices:

71 BROADWAY **NEW YORK.**

Cable Address, Uscipipe, New York.

Pacific Coast Sales Office:

507 UNION TRUST BUILDING **SAN FRANCISCO.**

H. G. AYLSWORTH

ELECTRICAL SUPPLIES

Temporary Office:

Cor. California and Pierce Streets, **San Francisco.**

California Incandescent Lamp Co.

Have Reopened at

606 MISSION STREET

Ground Floor, Atlas Building, **SAN FRANCISCO.**

WATERWORKS.

Oakland, Cal.—Judgment for damages to the amount of $128,426.42 has been awarded by Judge Ellsworth to Niehaus Bros. of Berkeley against the Contra Costa Water Company as the result of the burning down of the plaintiff's furniture factory two years ago, the defendant company being held liable because there was not sufficient water to fight the fire. The Contra Costa Water Company will appeal from the decision.

Colton, Cal.—The Armour Fertilizer Works contemplate making many improvements on their plant in Colton in the near future.

Santa Barbara, Cal.—J. B. Lippincott, consulting engineer for the Santa Barbara Water Works department, has returned from the tunnel and dam site at Gibraltar, in Santa Ynez Valley. He states that the completed plant will give sufficient water for all purposes of the city and irrigate 5000 acres and develop 1000 h. p., which will yield an annual income of $2,500,000.

Globe, Ariz.—The Pinal Mountain Water Company has voted $20,000 for a pumping plant the duplicate of the one now used. The company also contemplates the construction of a larger reservoir of 500,000 capacity and will install fire hydrants in the residence district.

San Jose, Cal.—Sealed bids will be received by the Supervisors up to August 7th for the construction of a pumping plant on the San Francisco road near Mountain View, in accordance with the revised plans on file with the Board Bids must be addressed to A. L. Hubbard.

Carson, Nev.—The Truckee River General Electric Company, owned by the Fleishhackers of San Francisco, has secured a foothold on the Carson River, where a generating plant will be built to supply power for pumping water for irrigation purposes on the large ranches.

San Rafael, Cal.—City Engineer and Trustee Pedrotti has been appointed by the Trustees to investigate the putting in of a larger pump at the salt water plant.

San Francisco, Cal.—On and after July 18th the general offices of the Westinghouse Electric and Manufacturing Company will be located at the corner of Second and Howard streets, San Francisco, and their entire force moved from the temporary Oakland office. Telephone numbers, Temporary 1658-1659.

Los Angeles, Cal.—A private right of way has been secured, it is stated, by the Los Angeles Pacific line extending from Fourth and Hill to Venice, and a four-track road will be started immediately. It is possible that Harriman will build a tunnel at Fourth and Hill streets.

Pasadena, Cal.—Lloyd R. Macy, secretary of the Oak Knoll Company, which is handling the Huntington interests in this vicinity, has been granted a franchisefor the extension of the South Lake avenue electric line to south city limits for $100.

New Lexington High Voltage Porcelain Co.

Manufacturers of

"Crown" Porcelain Insulators

C. S. KNOWLES

Sole Sales Agent.

BOSTON . ATLANTA NEW YORK SAN FRANCISCO

GOULD STORAGE BATTERY CO.

Main Office

1 West 34th St., New York Works, Depew, N. Y.

Temporary address

1701 GEARY ST., SAN FRANCISCO. Phone West 837.

Occidental Machinery & Engineering Co.

Removed to

609 Harrison St., cor. Second San Francisco

Back in the Old District.

West Coast Machinery Co.

WE CARRY IN STOCK

HOISTING ENGINES, GAS ENGINES, MACHINE TOOLS, MOTORS, ETC.

Temporary Office:

101 SANCHEZ STREET - - SAN FRANCISCO

We are prepared to build water wheels for all heads of water and power.

Knight's Water Wheels

From 2 to 6 feet in diameter and from 10 to 1000 horsepower. Wheels inclosed in iron cases from 6 to 24 inches.

KNIGHT & CO., SUTTER CREEK, CAL.

Fulton Iron Works Agents, San Francisco, Cal.

Electrical Supplies at Wholesale

Holabird-Reynolds-Sayles Co.

26 Minna Street SAN FRANCISCO

and

116 East Fifth Street LOS ANGELES

Hercules Gas Engine Works

Hoists, Stationary Engines, Electric Light Engines

Office and Works, Blanding Avenue., near Park St., ALAMEDA, CAL. Phone Alameda 91

HUNT, DILLMAN, MEREDITH & ALLEN, INC.,
Engineers,
200-202 California St., San Francisco.

DONALD C. JACKSON, C. E. and WILLIAM B. JACKSON, M. E.,
Electrical, Mechanical and Civil Engineers,
Madison, Wis.

H. M. BYLLESBY & CO., INC.,
Design, Construct and Operate Railway, Light, Power and Hydraulic Plants,
American Trust Building, cor Clark and Monroe Sts., Chicago.

EDWARD F. CANNON & CO.,
Electric and Hydraulic Engineers,
309 McKay Bldg., Portland, Ore.

C. L. CORY,
Consulting Engineer,
200 California St. San Francisco.

LEON M. HALL,
Consulting Engineer,
814 Hayward Building, San Francisco.

R. S. MASSON,
Consulting Engineer,
709 Pacific Electric Bldg., Los Angeles

W. STUART SMITH,
Consulting Engineer.
2538 Dwight Way, Berkeley, Cal.

H. C. THAXTER,
Electrical and Mechanical Engineer,
Atlas Building, 604 Mission Street,
San Francisco.

G. F. WAKEFIELD,
Surveyor and Engineer,
Room 22, Porter Bldg., San Jose, Cal.

VAN DER NAILLEN'S SCHOOL OF PRACTICAL ENGINEERING,
Telegraph Ave. and 51st St., Oakland.

CLEM A. COPELAND, M. E.,
Consulting and Supervising Electrical and Mechanical Engineer,
Citizens' National Bank Building, Los Angeles, Cal.

ROBERT McF. DOBLE,
Consulting and Supervising Engineer,
Colorado Springs, Colo.

MUTUAL GAS AND ENGINEERING COMPANY,
Consulting Engineers and Builders of Gas Plants,
202 Union Bank Building, Oakland.

SMITH, EMERY & CO.,
Chemists and Chemical Engineers,
1104 Broadway, Oakland.

RUDOLPH W. VAN NORDEN,
Consulting Engineer,
105 Bacon Bldg., Oakland.

N. J. NEALL,
Consulting Electrical Engineer.
(Specialty Lightning Protective Apparatus.)
12 Pearl Street, Boston.

GEORGE H. ROWE,
Consulting Electrical Engineer.
Specialty: Designing of Alternating Current Apparatus and Transmission Systems.
1211 Fisher Building, Chicago.

The Journal of Electricity Power and Gas

WEEKLY

$2.50 PER YEAR

Less than FIVE cents per copy.

Can YOU afford to be without it?

Journal of Electricity Publishing Co.

701 ATLAS BUILDING

604 MISSION STREET SAN FRANCISCO

NATIONAL CONDUIT AND CABLE CO.
Manufacturers celebrated National Weather-proof, Bare, Transmission and Trolley Wire, Lead Sheathed Paper, Insulated Telephone, Telegraph and Power Cables.
Temporary offices with Oakland Traction Consolidated, 708 SAN PABLO AVE., OAKLAND. C. H. PENNOYER, Pacific Coast Manager.

OHMEN GAS ENGINE CO.
Now located at
15th and Utah Sts. SAN FRANCISCO

Linemen's Tools
Send 2c stamp for Catalogue.
MATHIAS KLEIN & SONS,
95 West Van Buren Street Chicago.

A. LEITZ & COMPANY
Surveying Instruments,
Temporarily at 918 **Broadway, Oakland.**

THE JOHN BARRETT CO.
408-410 Morrison Street, Portland, Ore., Can Supply
Tile Flooring, Mantels, Electroliers, Incandescent Gas Lamps and Electrical Supplies.

The Paraffine Paint Co.
Oakland Office, Union Savings Bank Building.
San Francisco Office, 1306 Post Street.

Heald's Business College
(Consolidated with the Dixon College.)
Is open, day and evening, in the Bacon Block, Oakland; also at 1451 Franklin Street, S. F.

T. P. ANDREWS
KODAKS TO RENT
SAN FRANCISCO

Bonestell, Richardson & Co.
Dealers in PAPER
473 to 485 Sixth St., near Bryant SAN FRANCISCO

G. E. Witt Co.
Of San Francisco
Little Giant and Incandescent Oil Burners, Pump Governors. Manufacturer of Brass Goods, Machinery and Supplies.
755 7TH STREET, OAKLAND
Phone Oakland 7660.

Engineers Wanted

Chas. C. Moore & Co., Engineers, are desirous of securing first-class draftsmen to work on the design of a 15,000 Kw. steam power plant which they have under contract.

Apply to Chas. F. Allardt, chief draftsman, 417 Fourteenth St., Oakland, Cal.

Good wages for good men. Only first-class men need apply.

You Must Have CLEAN BOILERS TO PRODUCE CHEAP POWER
DEARBORN FEED WATER TREATMENT will keep the Boilers Clean and at Low Cost
DEARBORN DRUG AND CHEMICAL WORKS
NEW YORK, 299 Broadway SAN FRANCISCO CHICAGO, Postal Telegraph Building